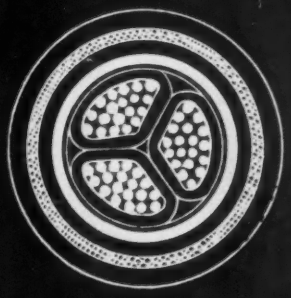
ELECTRICAL
TIMES

BICC



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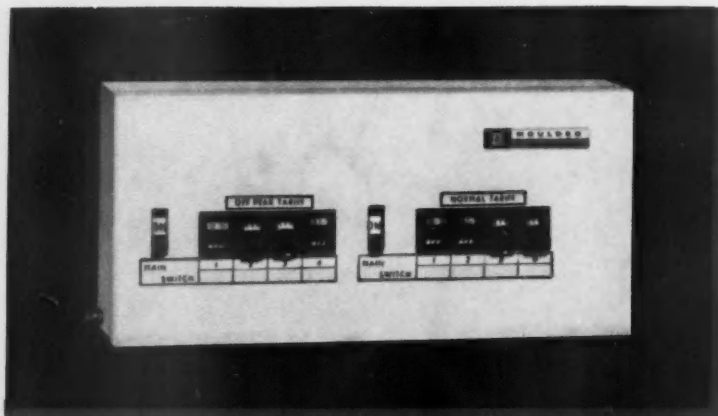
Immediate deliveries — Competitive prices

Install THE Stab-lok CONSUMERS' SERVICE UNIT

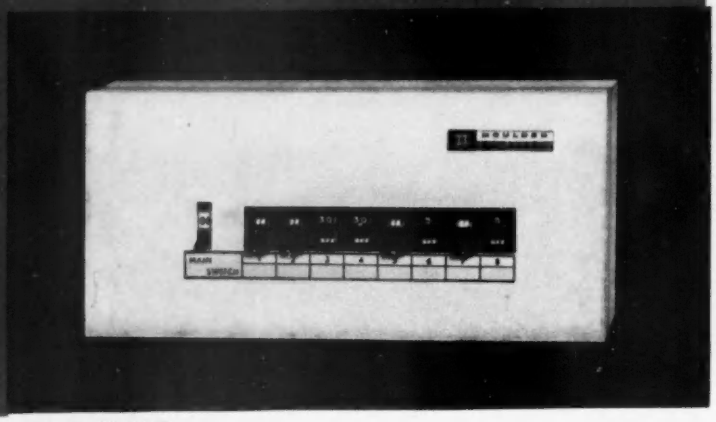


Stab-lok Circuit Breakers, the most proven Circuit Breaker, have now been incorporated into a range of Domestic Consumer Units. These Units form a comprehensive range from 4 to 12 ways for use on single tariff and 4 to 8 ways for use where two part tariff control is required.

The Units are enclosed in sheet steel enclosures protected and finished by an undercoat and top coat of neutral shade stoved enamel. The Units are complete with busbars of 60 amperes capacity, 60 ampere double pole slow make, slow break isolating switches, neutral and earthing busbars.

The Units can be mounted surface or flush and have facilities for conduit entry or back entry of cables.

All Consumer Units will accommodate Stab-lok Circuit Breakers with ratings of 5, 15, 20, 25, 30, 40, 50 and 60 amperes.



RANGE

Catalogue No.	Description	Length	Height	FLUSH Pattern
FOR STANDARD TARIFF				
DU. 4	4 way S.P. & N.	8¾"	Overall height of boards 7" Overall depth 2⅜" plus ⅝" projection for circuit breaker handles	For Flush boards add 1¼" to length and ¾" to height
DU. 8	6 & 8 way S.P. & N.	15¼"		
DU. 12	10 & 12 way S.P. & N.	19¾"		
FOR TWO PART TARIFF				
DU. 4/4	4/4 way S.P. & N. (8 breakers)	15¼"		
DU. 4/8	4/8 way S.P. & N. (12 breakers)	19¾"		

British made to British requirements

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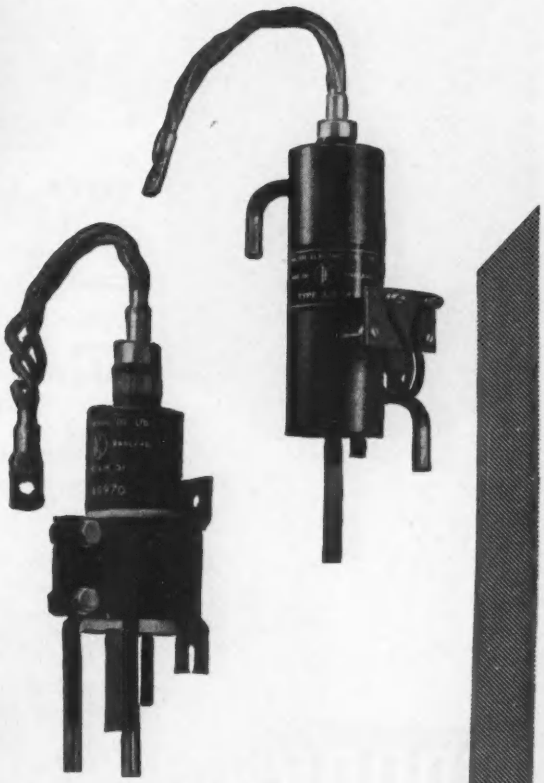
E.C.C. (MOULDED BREAKERS) LTD. Publicity Dept., Wolverhampton Publication MB/CUL/0561

Required by .....

Ignitrons for welding control



Accuracy and reliability of welding control are ensured by installing 'ENGLISH ELECTRIC' ignitrons, available from stock in the international sizes A, B and C.

Size C is illustrated above, with A and B on the right. Size A may be used air-cooled or with the water-cooled clamp shown. Thermostats may be fitted on the size B and C tubes and on the size A clamp.

'ENGLISH ELECTRIC'

Technical literature on 'ENGLISH ELECTRIC' ignitrons will be sent on request.

RECTIFIER SUBSTATION DEPARTMENT, STAFFORD

The English Electric Company Limited, English Electric House, Strand, London, W.C.2.

RG.7

A

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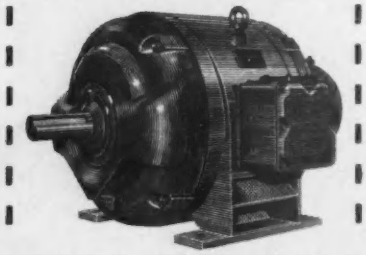

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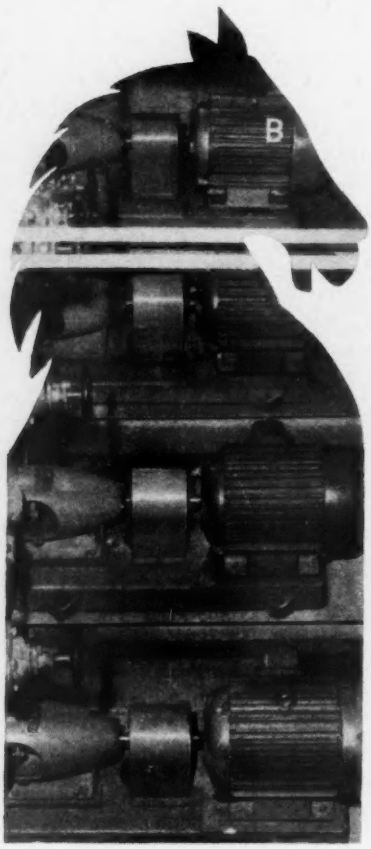

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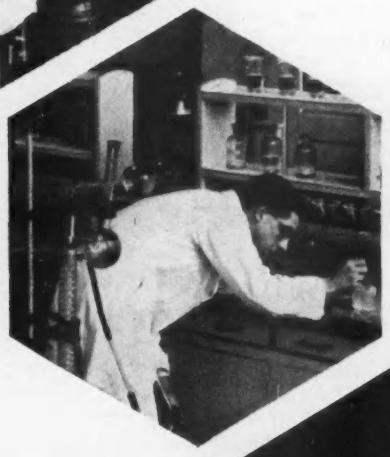

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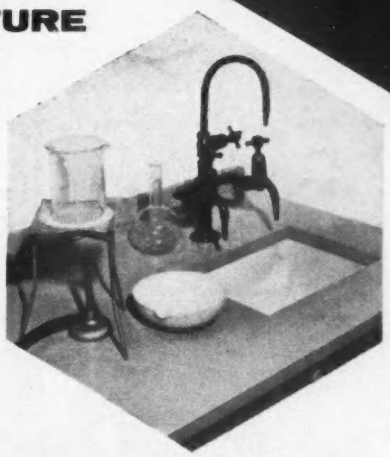

Full details are incorporated in illustrated technical publication E. 118 available from our Electrical Insulation Sales Department

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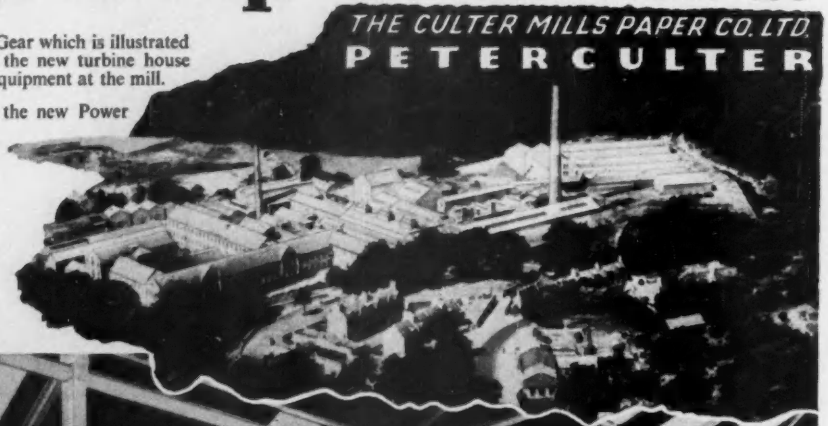
PETERCULTER

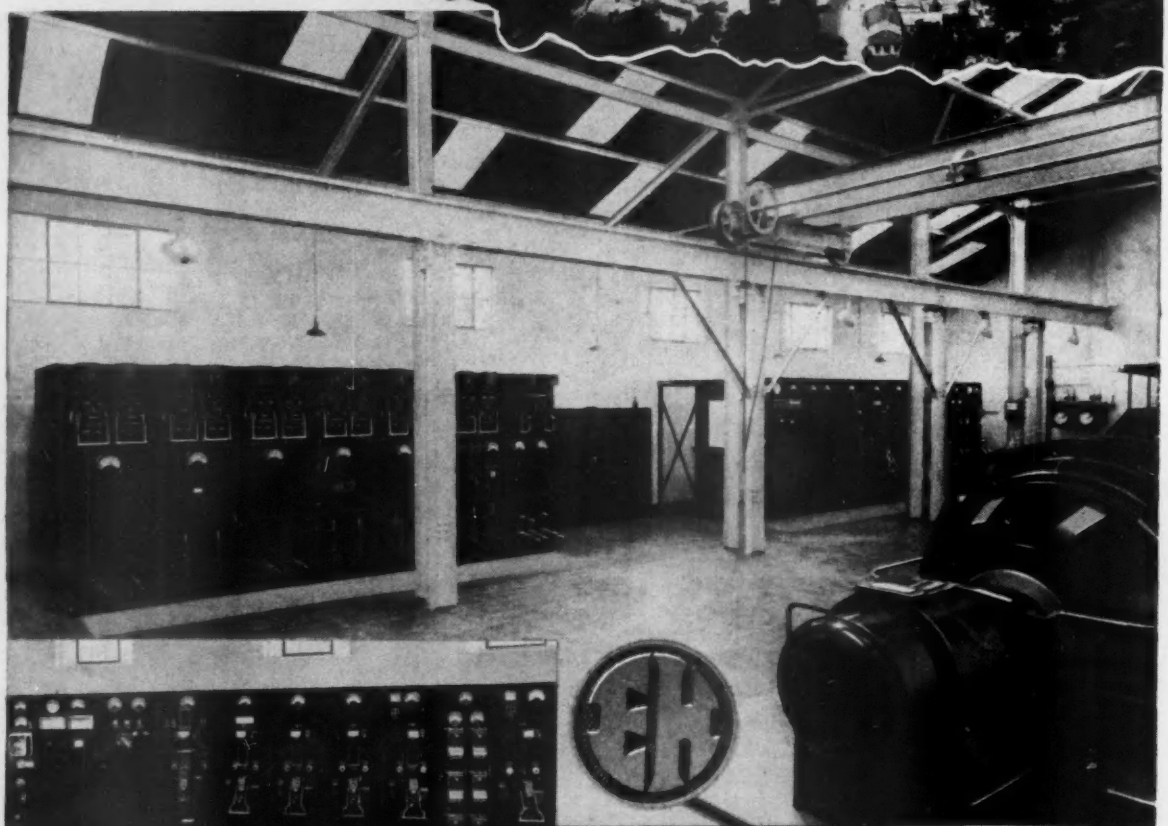
The Switchgear and Motor Control Gear which is illustrated below is part of the installation of the new turbine house and modernisation of the electrical equipment at the mill.

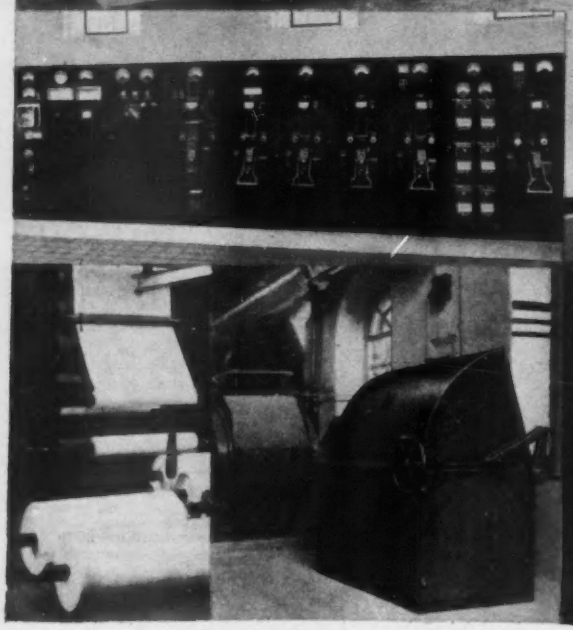
The large centre illustration shows the new Power House with the A.C. and D.C. Switchgear for controlling the 2400 KW Alternator and the 850 KW D.C. generator of the new turbine set.

In the lower illustrations are other switchboards and motor control gear typical of those throughout the mill.

Consulting Engineer, A. B. Mallinson, M.I.Mech.E., M.I.E.E.







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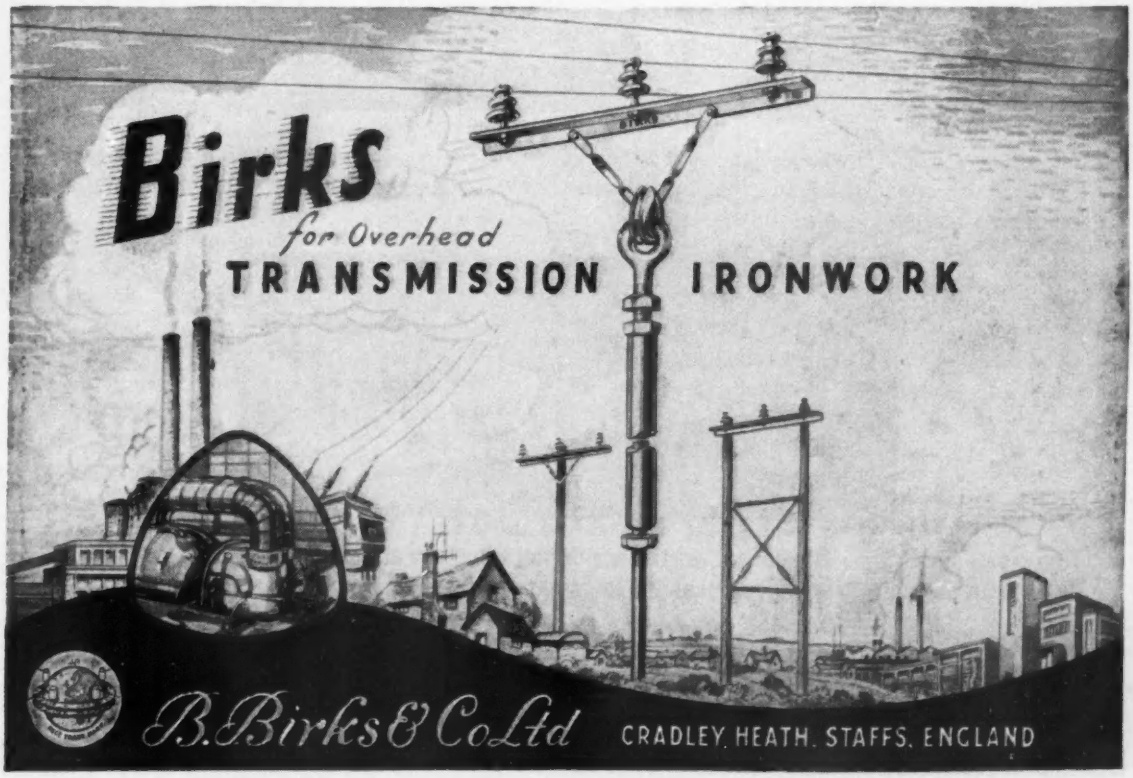

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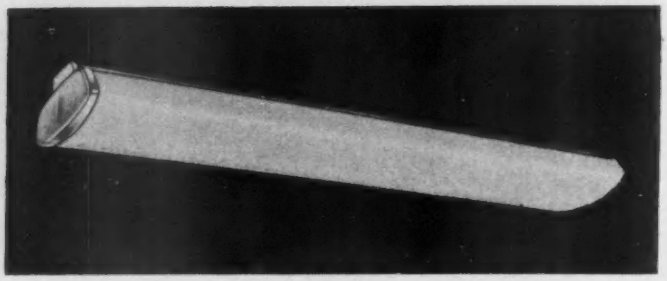

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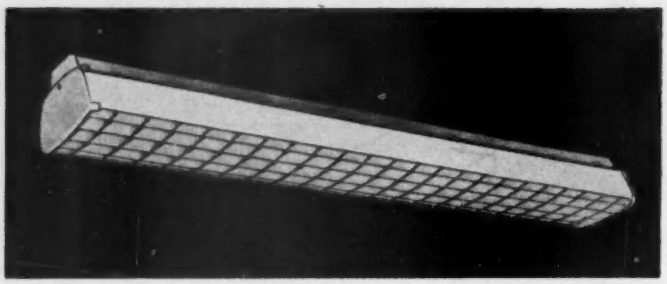

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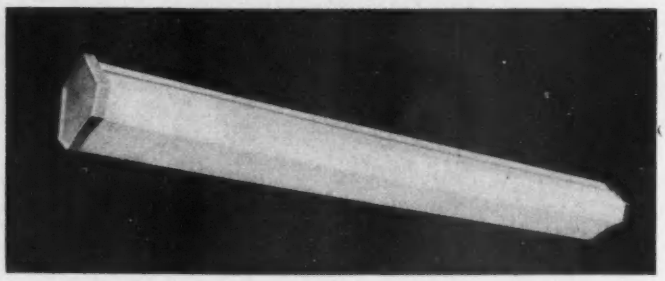

These facts about 'New-Range' are worth considering when you are planning lighting: Our branches throughout the country will give you all the information you need: and they have the fittings in stock.

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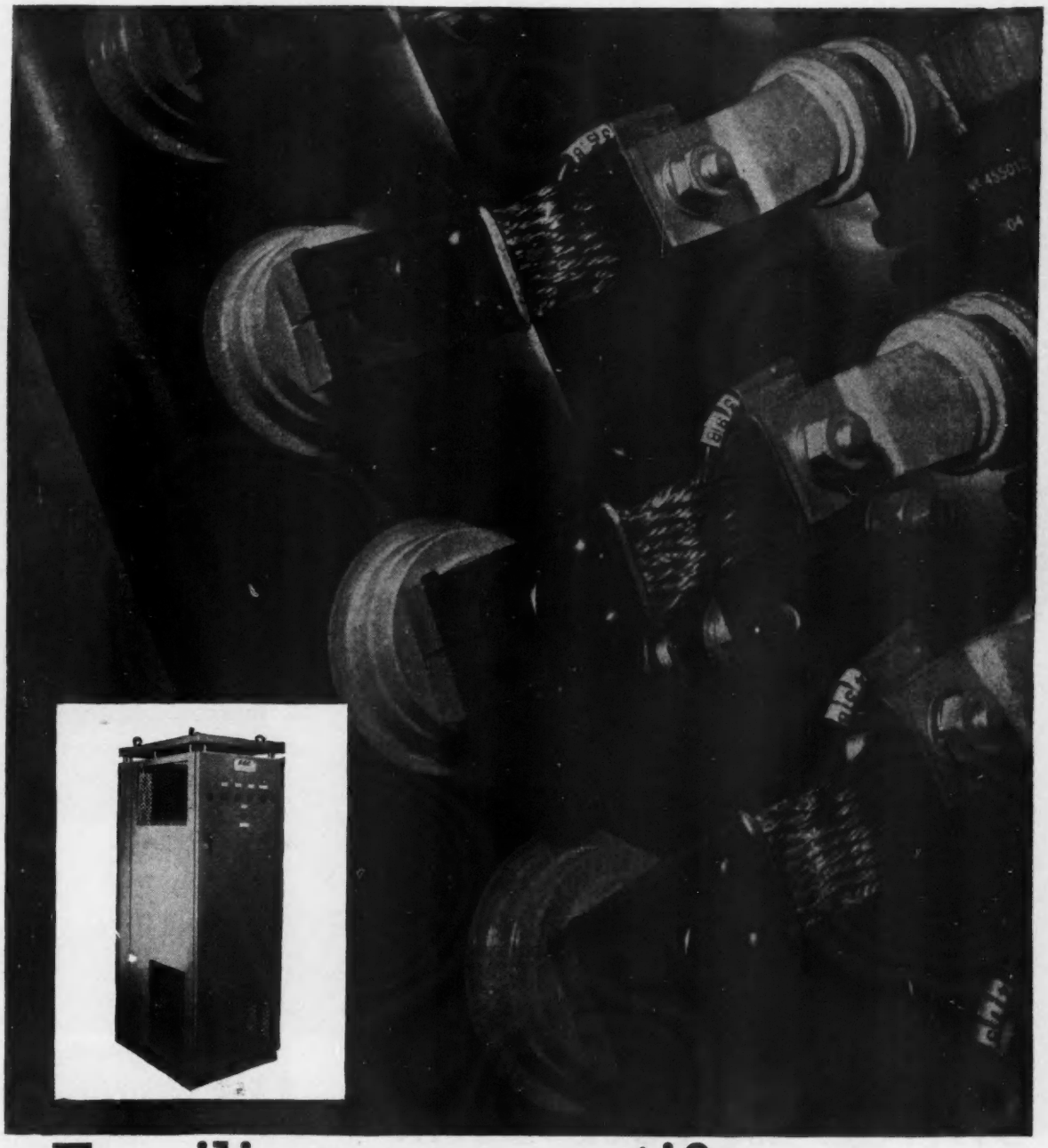

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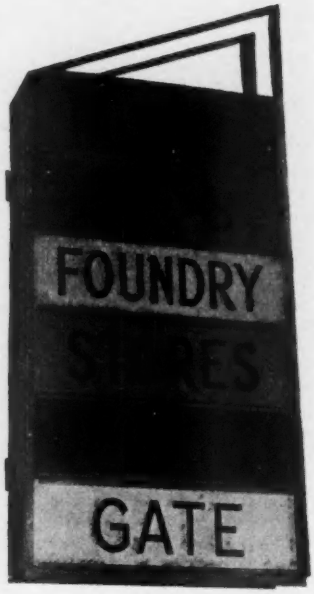

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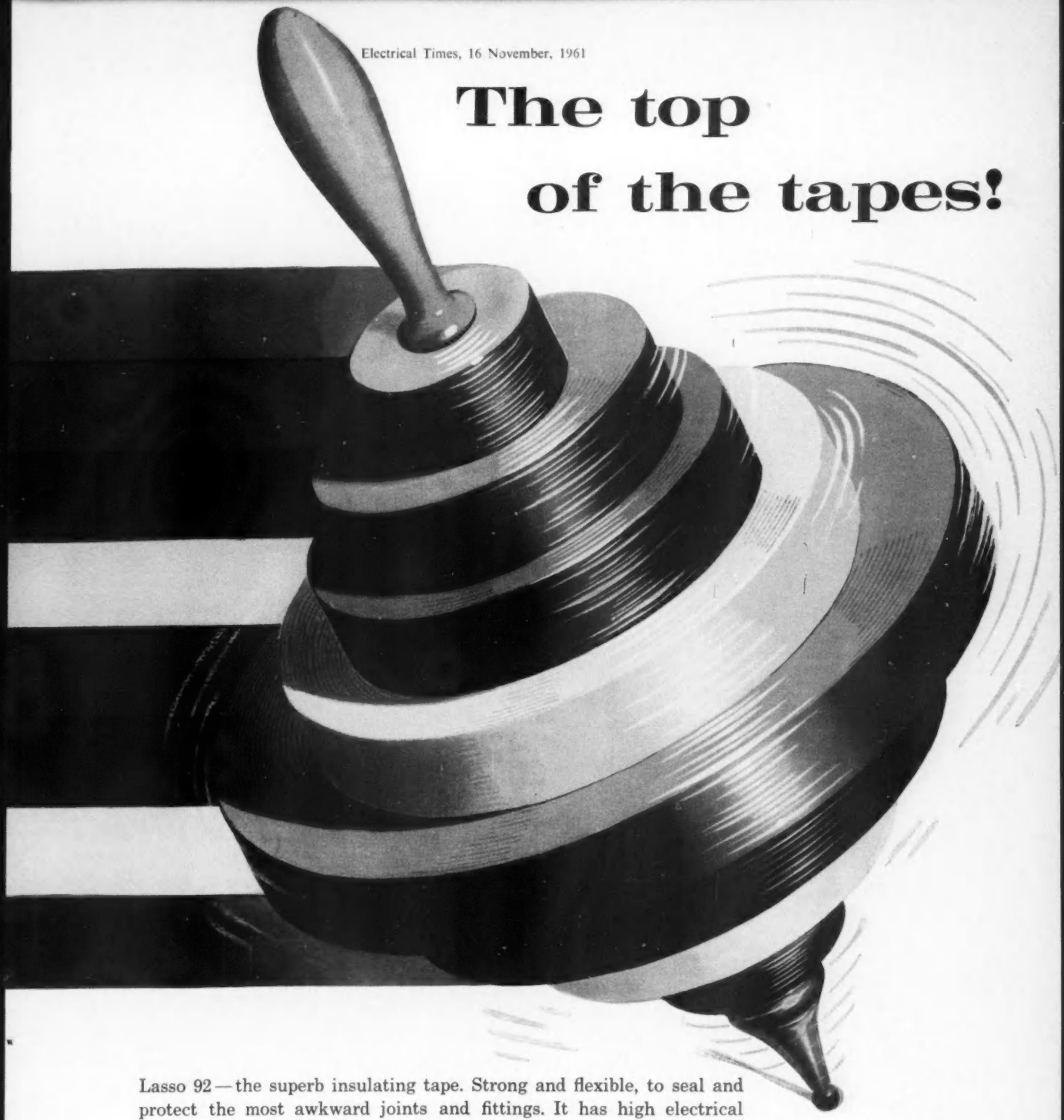
The top of the tapes!



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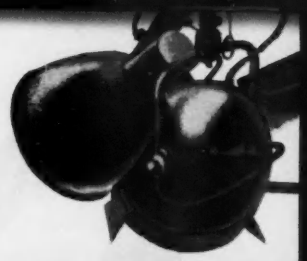

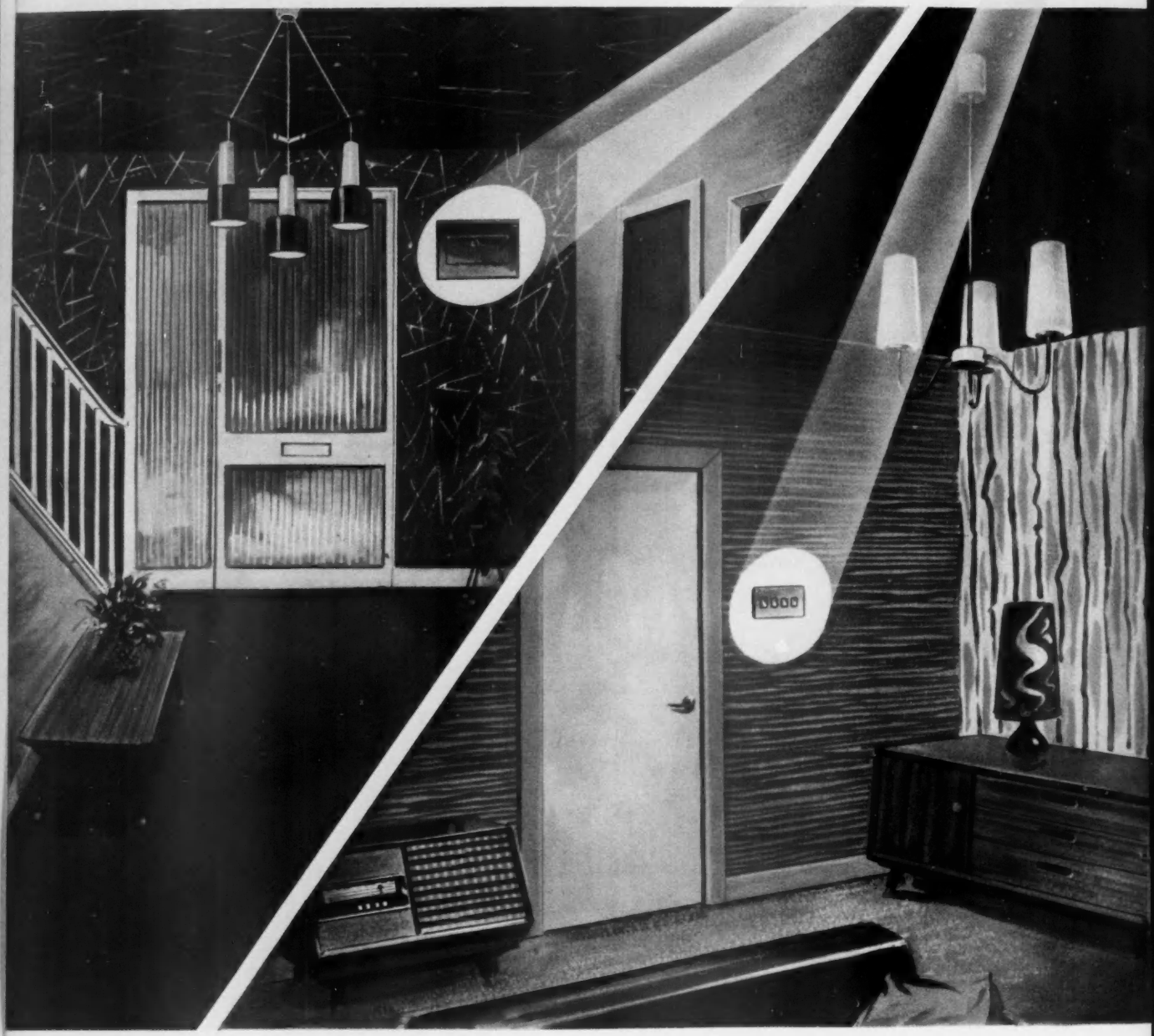

An electrical installation is largely buried in the walls and ceilings: all that remains visible are the wiring accessories—the parts which will be operated by the user and on which he will judge the installation as a whole. The engineer will therefore want the accessories to reflect the sound planning, the high quality of the materials and the skilled craftsmanship which he has put into the installation. That is why the discriminating engineer will continue to install "Crabtree" at every point.

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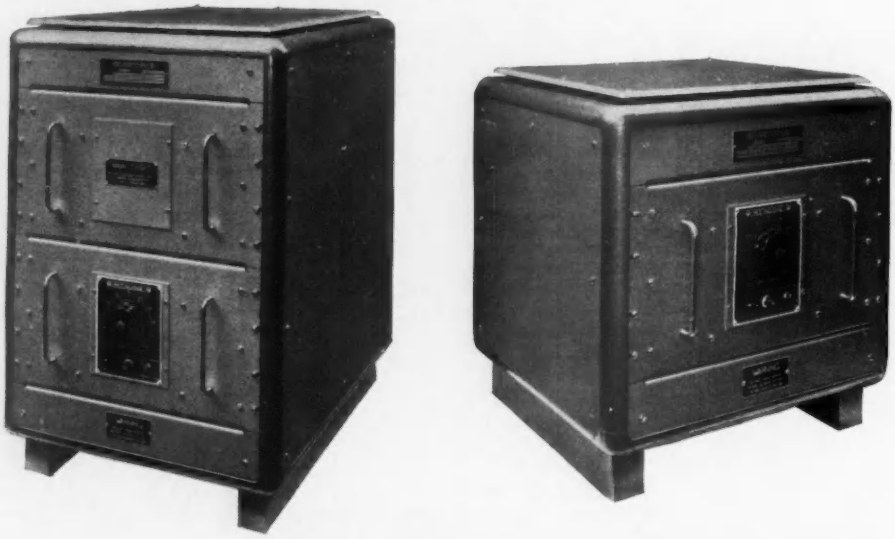

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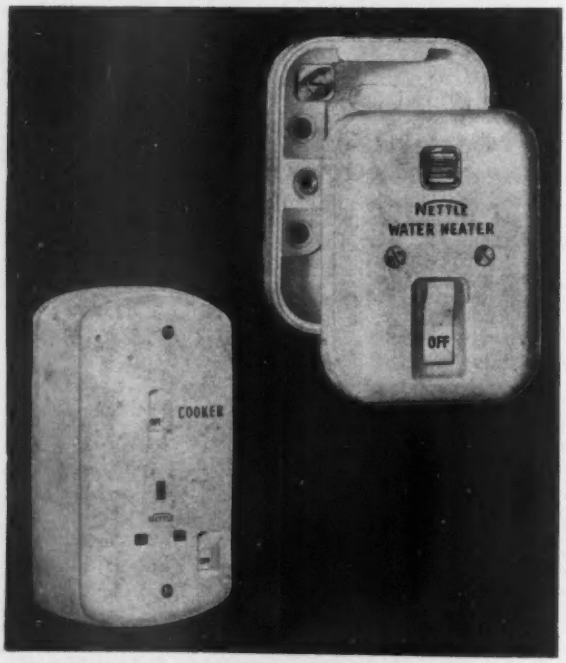

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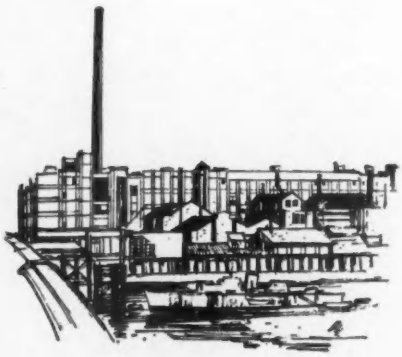
(There are 273 feet of it)*



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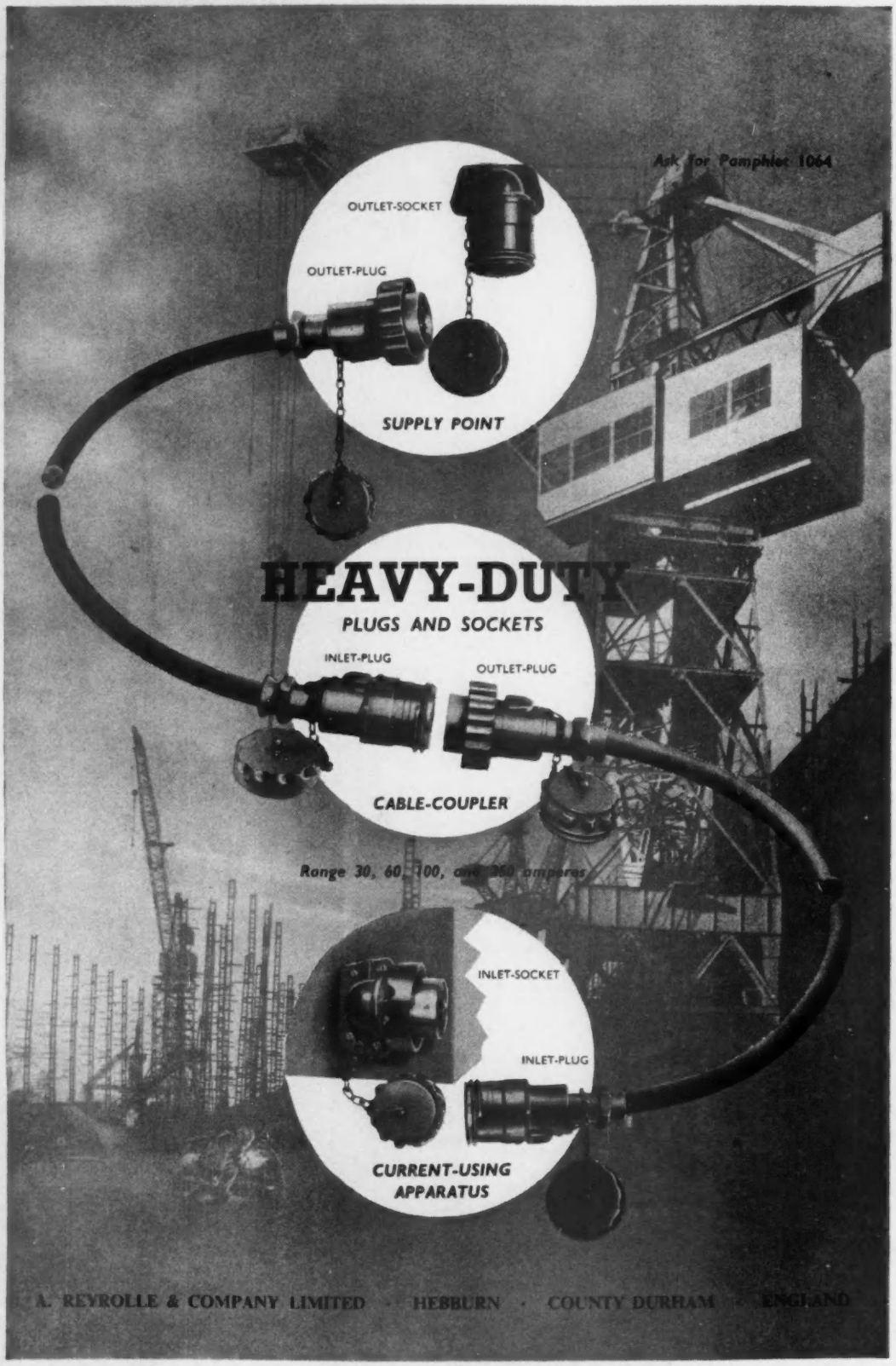
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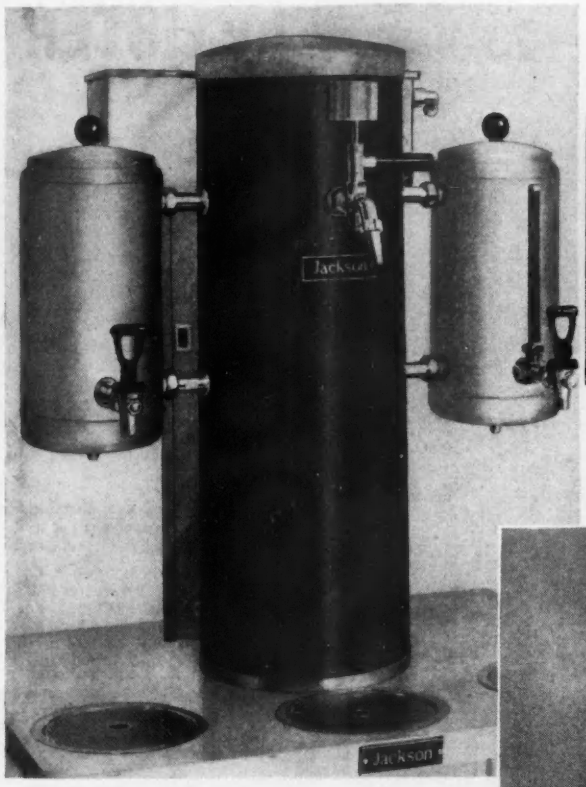

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Boilers you can trust

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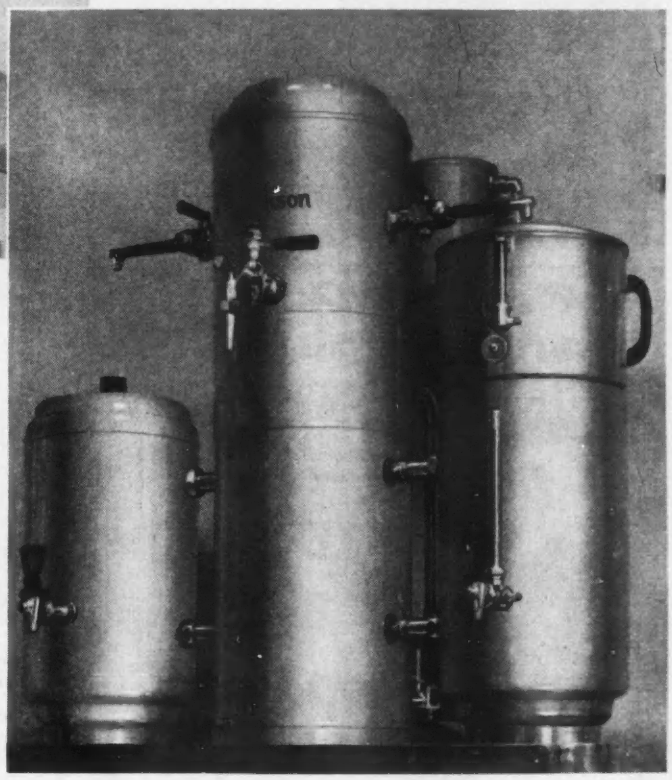
In their recently opened Dragon Hotel, Swansea, Trust Houses Ltd. rely on Jackson Boilers for a non-stop output of positively boiling water for tea and coffee making.



A 'Jackson' F7E, one of the counter sets in use at the Dragon Hotel.

Jackson Boilers Ltd.

FULLERTON PARK, ELLAND ROAD, LEEDS, 11 Tel: 76673-7

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This sturdy, mechanical trencher and back-filler will dig from 3" to 4" wide to 5'-6" deep, and can now be fitted with a Lister SL.2 diesel engine, giving increased power for an even wider variety of work.

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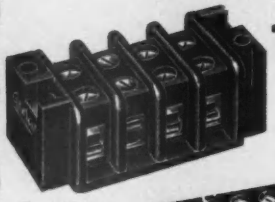

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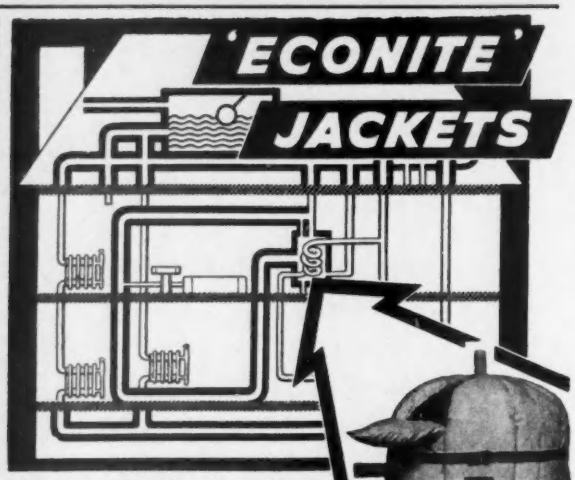

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'Econite' Jackets for cylinders and tanks are designed to maintain water temperature with the minimum of heat, so saving on fuel bills. A recent test over a period of 22 hours showed that a 20 gallon cylinder covered with an 'Econite' Jacket and holding water at a temperature of 150°F in a room temperature of 46°F cooled at the rate of only 1·79°F per hour.

'Econite' Jackets are supplied complete with aluminium bands and fixing clips and are available in stout White or Brown Canvas, Cream Plastic Coated Cloth, Cream Plastic Film and Cream American Cloth finishes.

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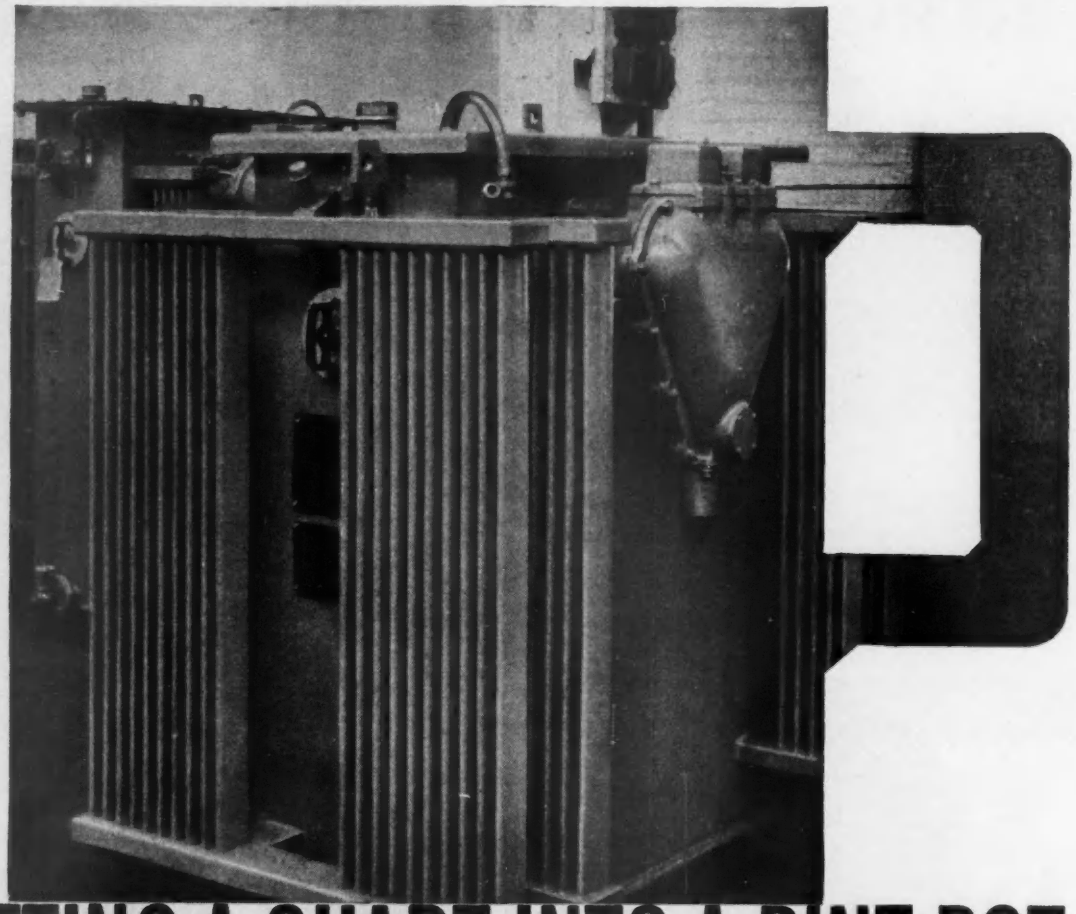

GETTING A QUART INTO A PINT POT

The compactness of the present range of Brush T.1. Distribution Transformers will be particularly appreciated by authorities who find it necessary to increase output of their existing transformer sub-stations to meet increasing demands for power, without carrying out major alterations to buildings. A modern Brush 500 kVA transformer can be placed in a sub-station building originally designed for a 300 kVA transformer, with room to spare for housing the larger associated switchgear. Besides being extremely compact this new series of T.1. Transformers greatly reduce noise level.

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NEWS SHEET

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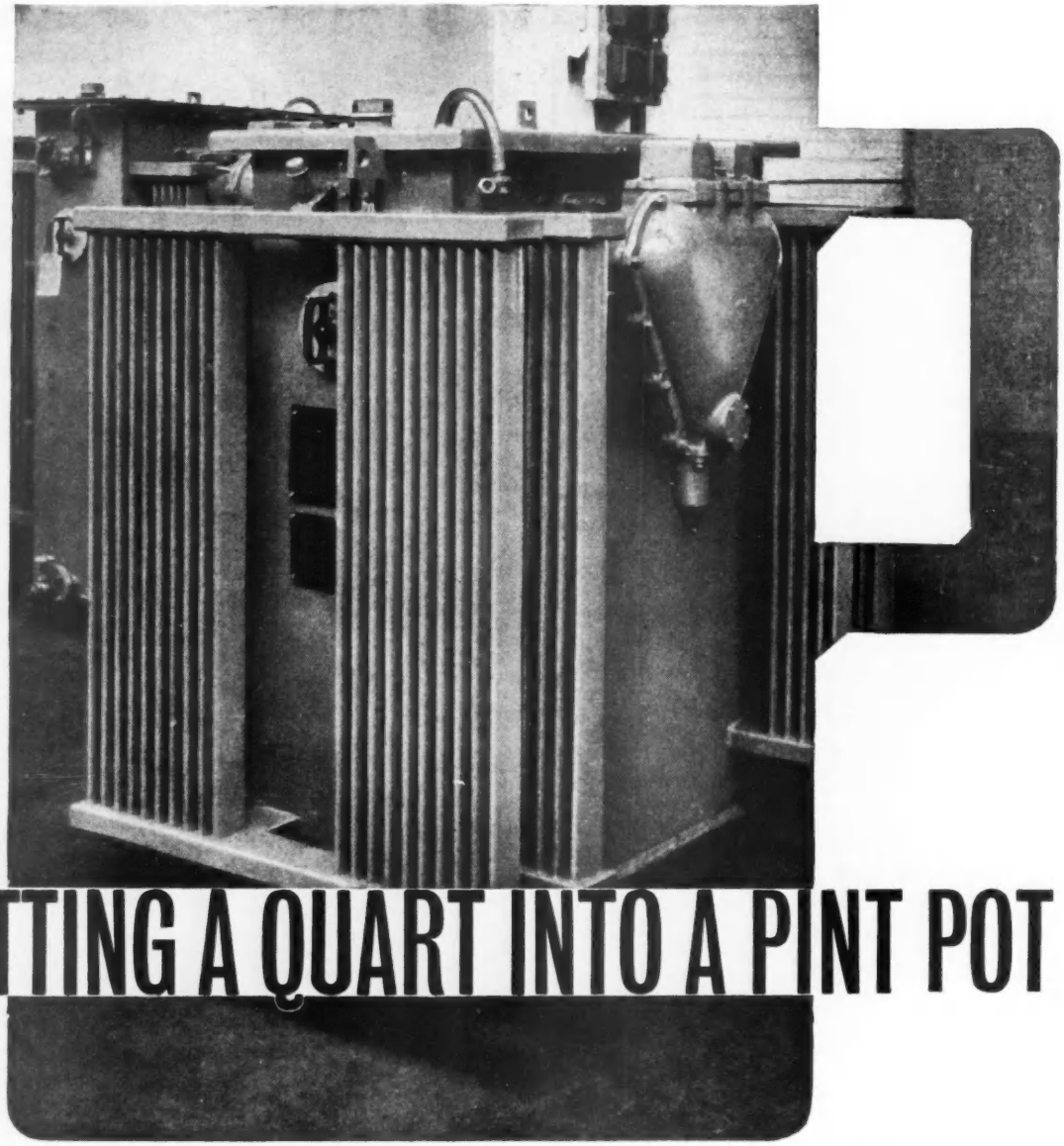

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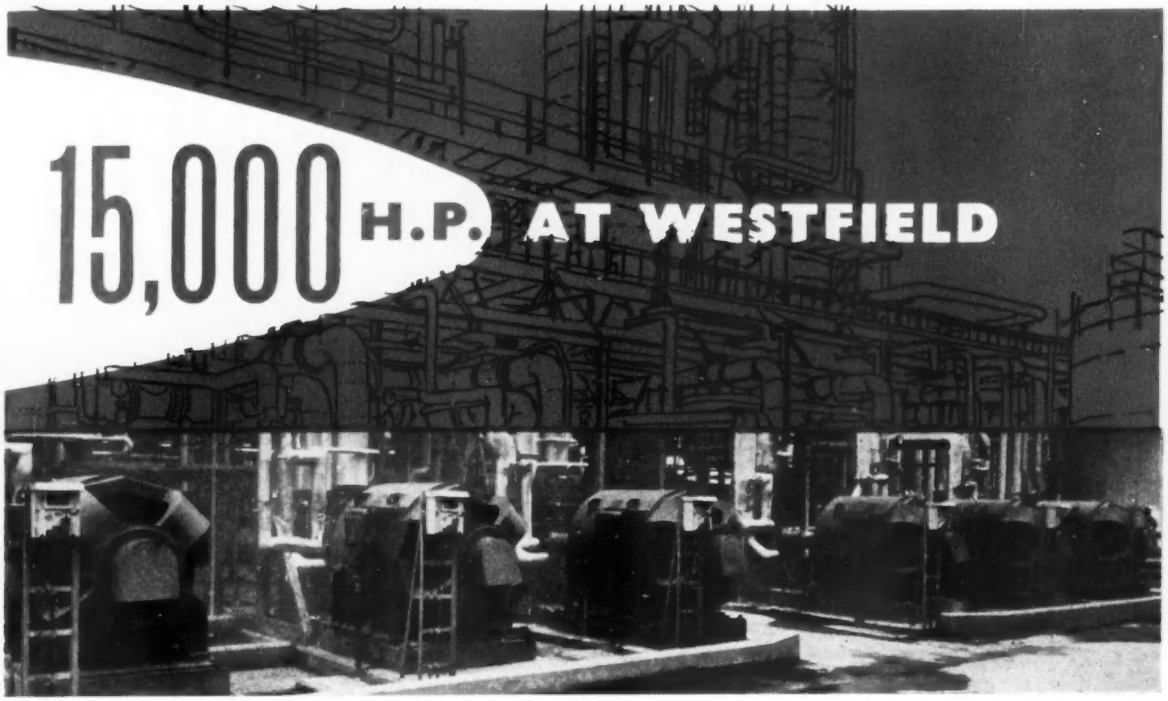
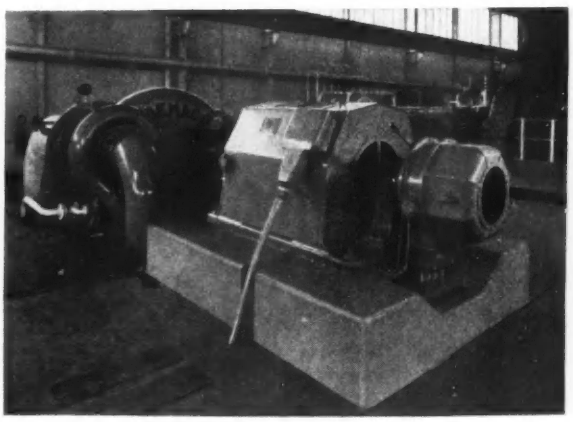


A group of closed-air-circuit weatherproof squirrel-cage induction motors driving carbonate pumps. Of 225 and 350 h.p. at 2950 r.p.m. these machines are direct-on-line started and operate at 3·3 kV.

Bruce Peebles manufactured the majority of the motors for the Scottish Gas Board's "Lurgi-type" high-pressure gasification plant at Westfield, Fife. Some 220 motors totalling over 15000 h.p. and of almost every type and enclosure were supplied, and amongst the unusually wide variety of motor applications are reciprocating compressors, various types of pumps, fans and boosters, and conveyors. Also supplied were induction generators for process energy recovery, and the control panels for the larger slipring and synchronous induction motors.

One of two 1450 h.p. 375 r.p.m. 3·3 kV screen-protected salient-pole synchronous induction motors driving reciprocating compressors.



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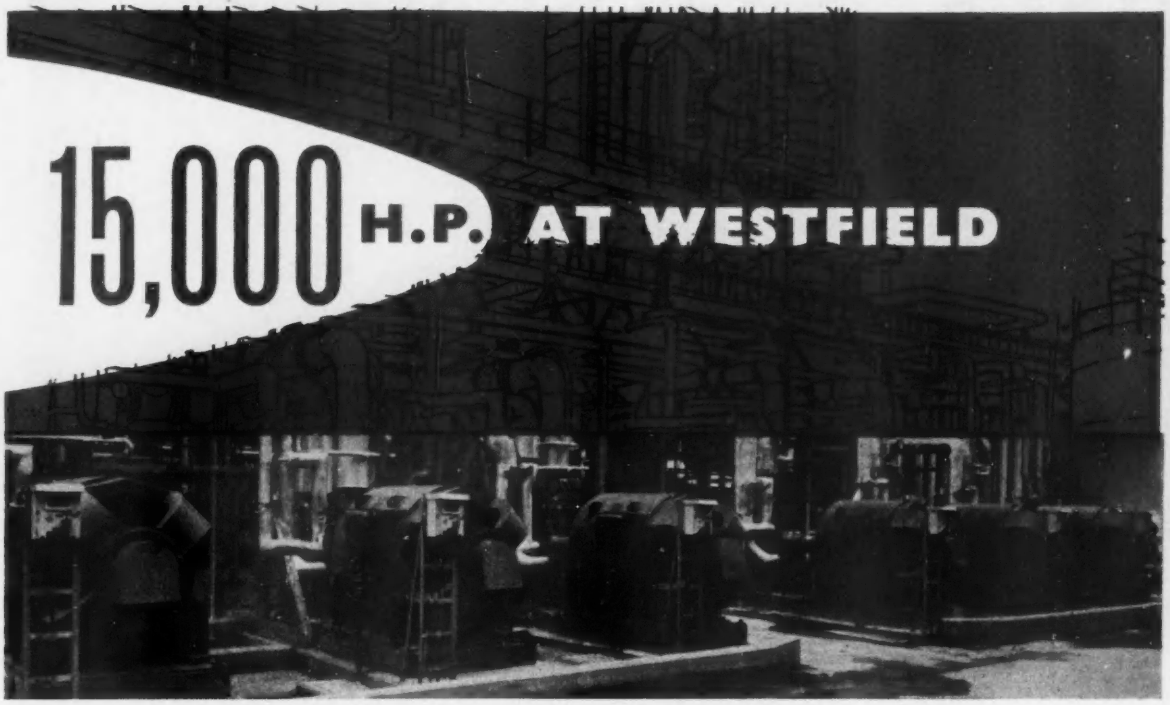

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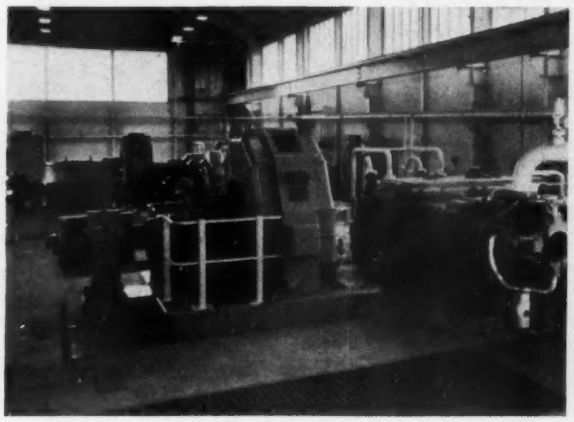

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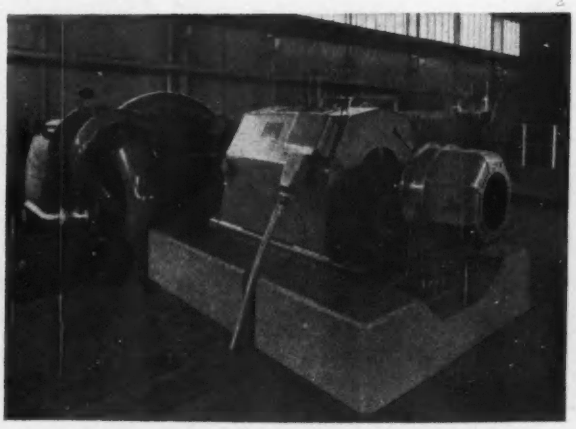

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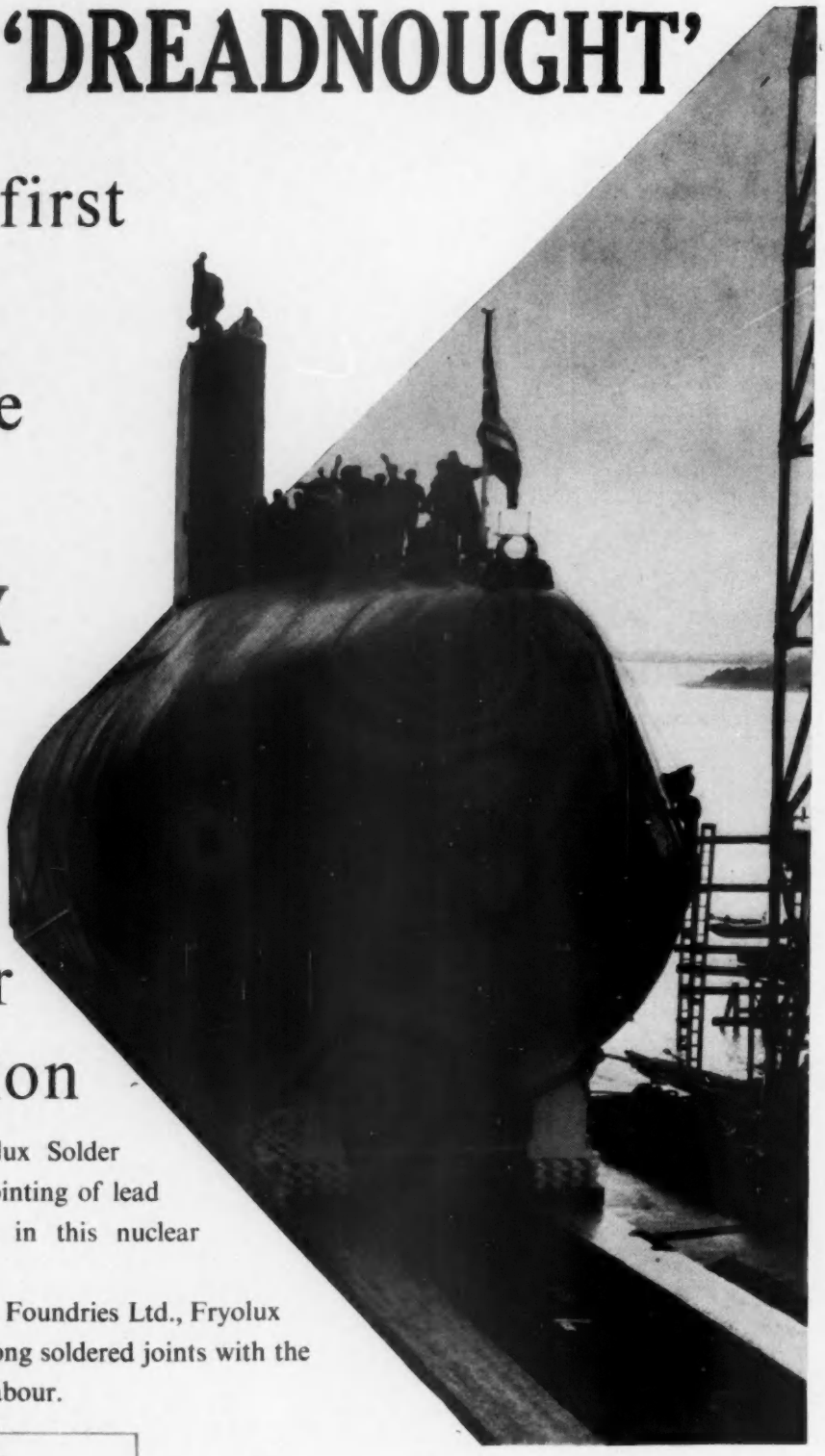

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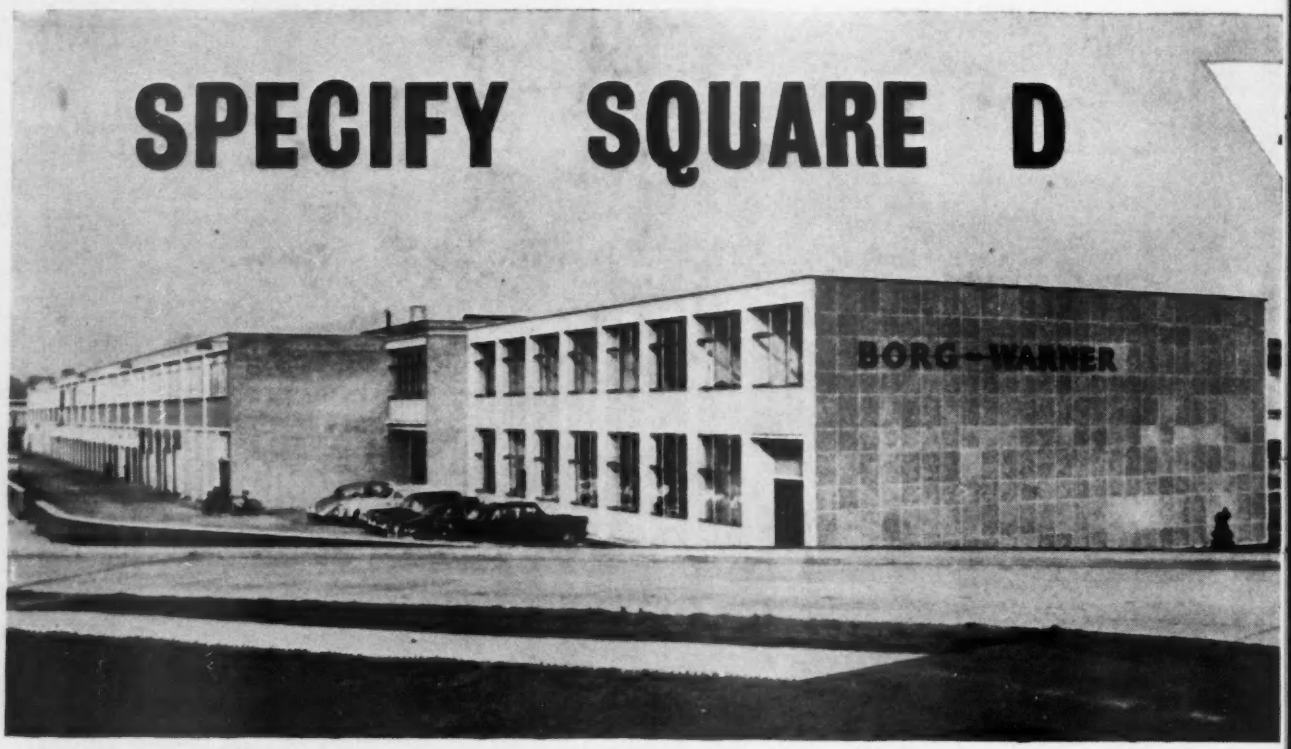

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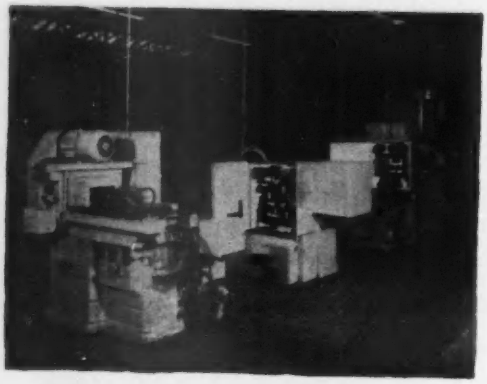

A group of machines, fitted completely with Square D Control, working on the Servo Piston and Body of the Model 35 Automatic Transmission.

£4 million plant extension of approximately 140,000 sq. ft. incorporating well over 400 new machine tools for the manufacture of Model 35 Automatic Transmission Unit for use on 1½-litre cars.

SQUARE D Control Gear has been used extensively throughout this plant.

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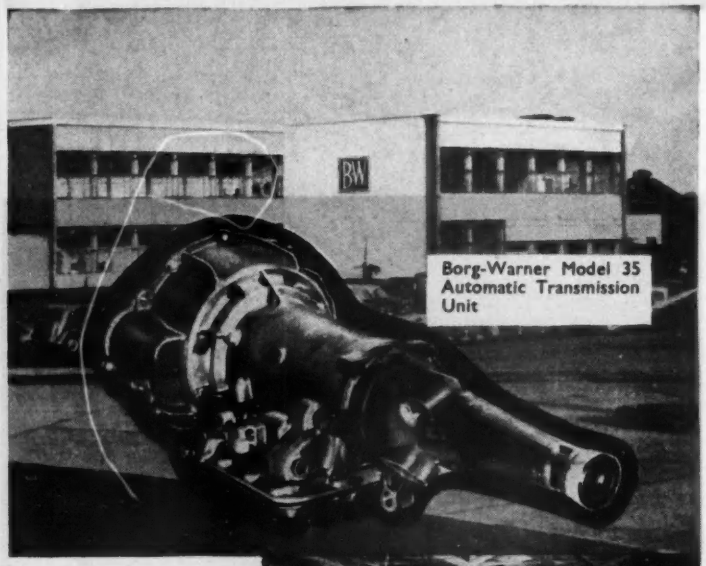

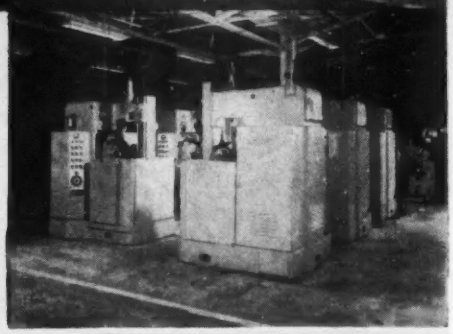

A group of Churchill Gear Machines, fitted throughout with Square D Control, working on the Model 35 Automatic Transmission Shaft and Bushing Assembly

Some of the BSA Multiheads, all using Square D Control, employed on the Model 35 Automatic Transmission Centre Support and Inner Race.

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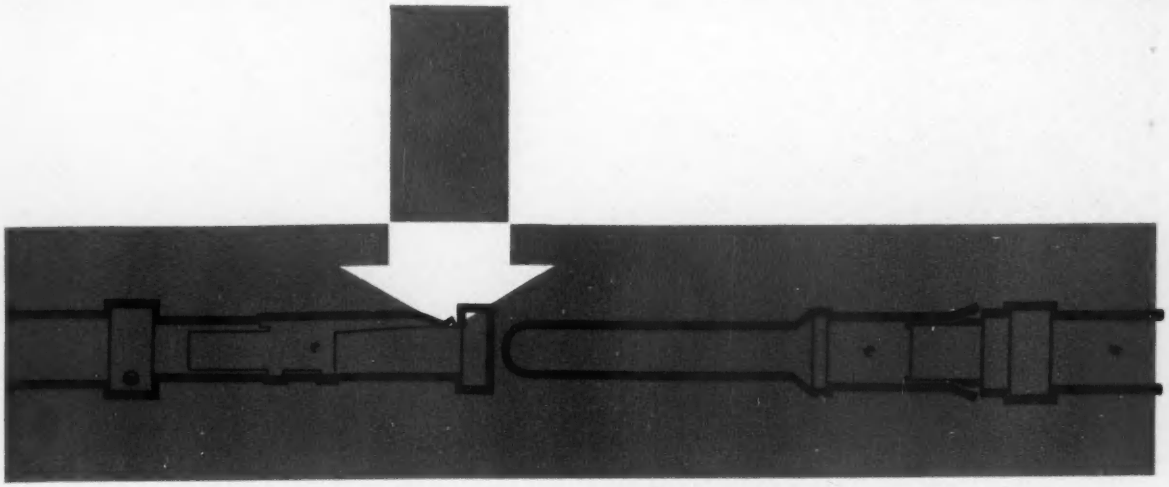

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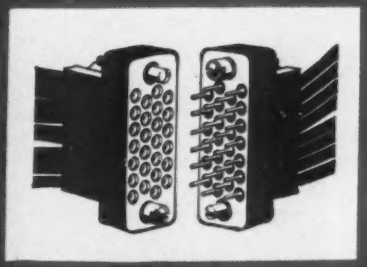

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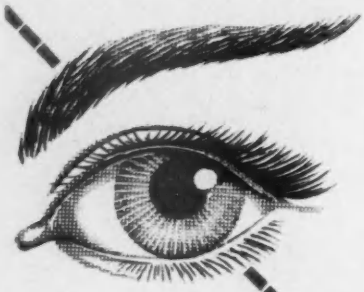

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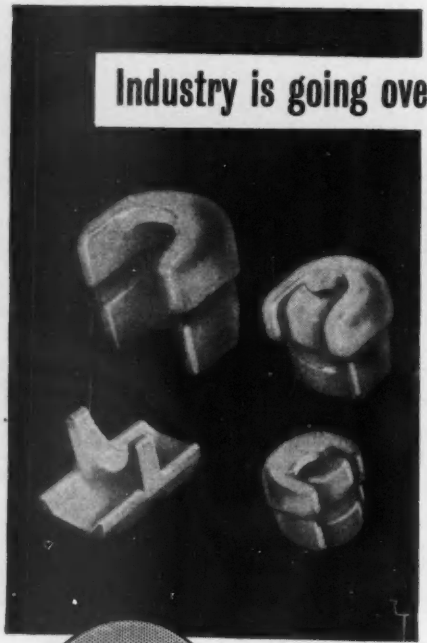

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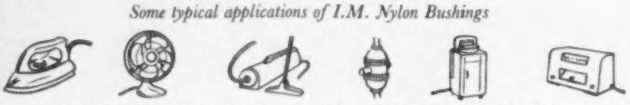

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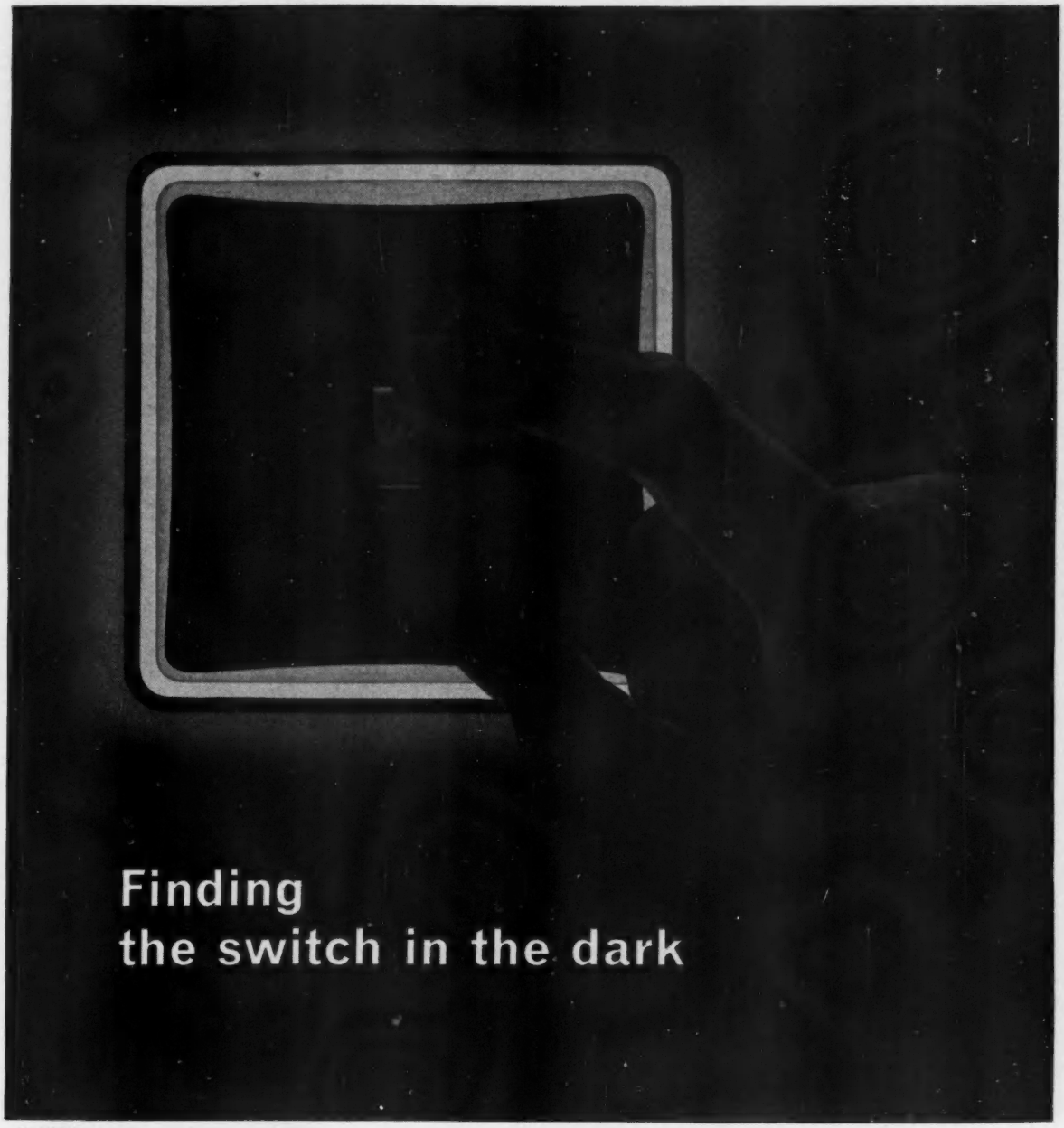

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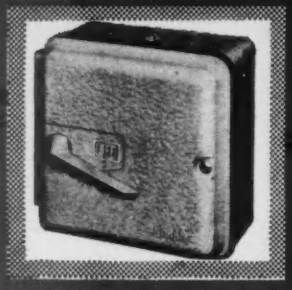

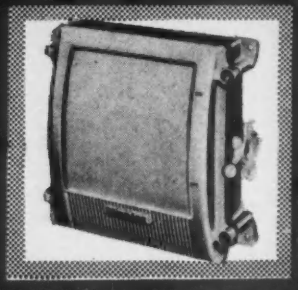

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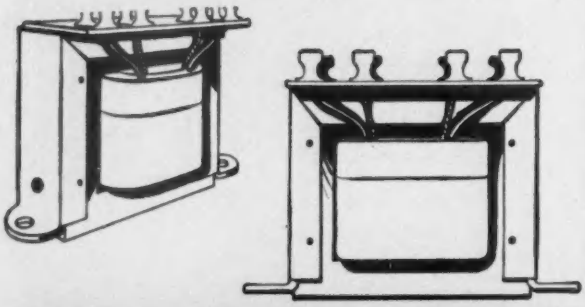

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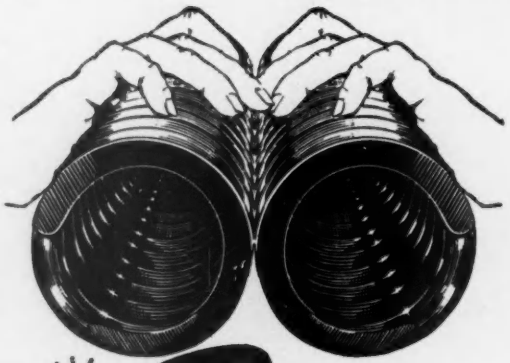

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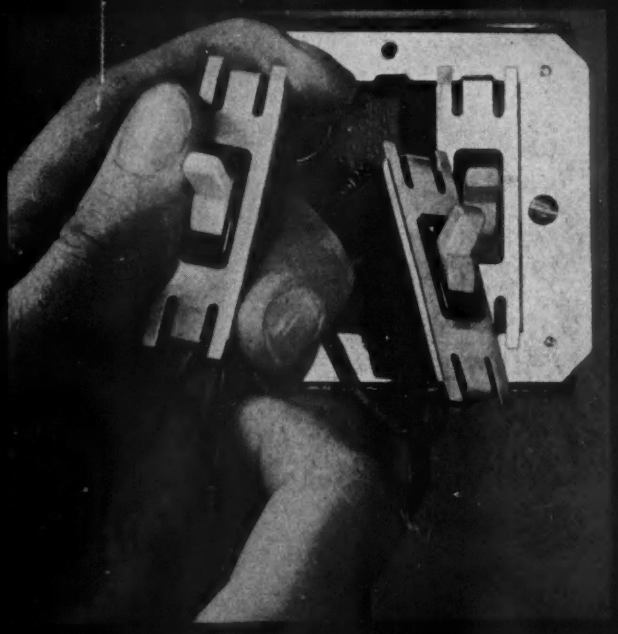

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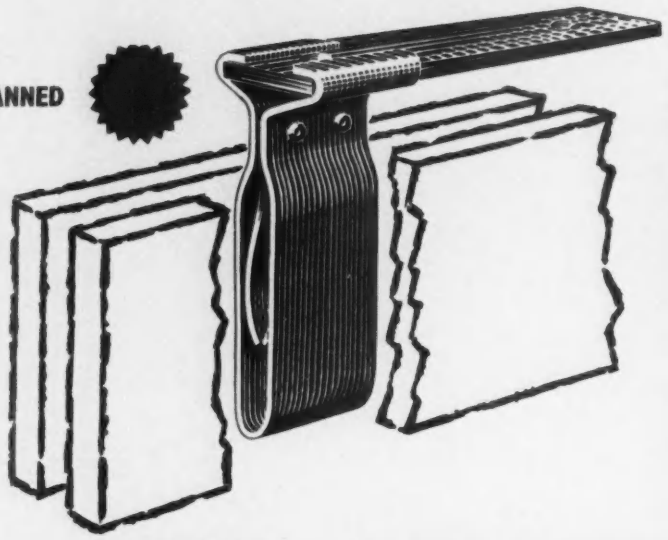

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The heart of a plug-in busbar system is the plug-in contact. The Barduct contact is designed to plug between the twin bars forming each phase conductor. Contact pressure is provided by heavy steel back-up springs which force the hot dip-tinned copper contact shell outwards. Ample resilience is provided to cope with normal production tolerances in components. The smoothly rounded tip of the contact ensures easy location during the process of fitting. Batch sampling of these contacts at twice their working load ensures reliability. Independent tests by N.P.L. have shown the P.D. at each contact to be not greater than 14 mV.

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Barduct trunking is 5½" wide and less than 2" deep and rated at either 150 amp or 250 amp per phase. Each conductor is enclosed and separated from the other throughout its length in high grade insulation, giving extreme reliability.

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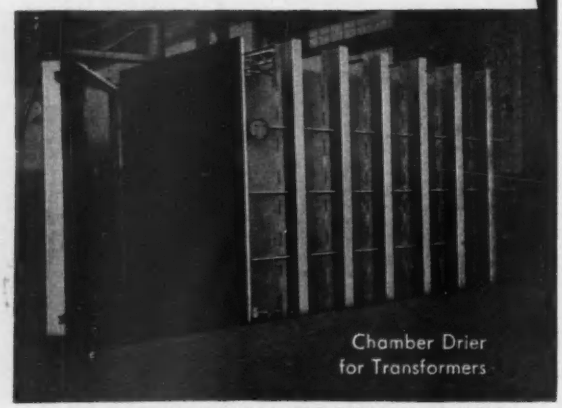

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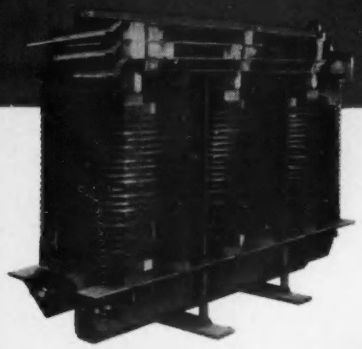
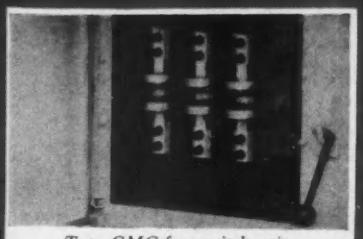
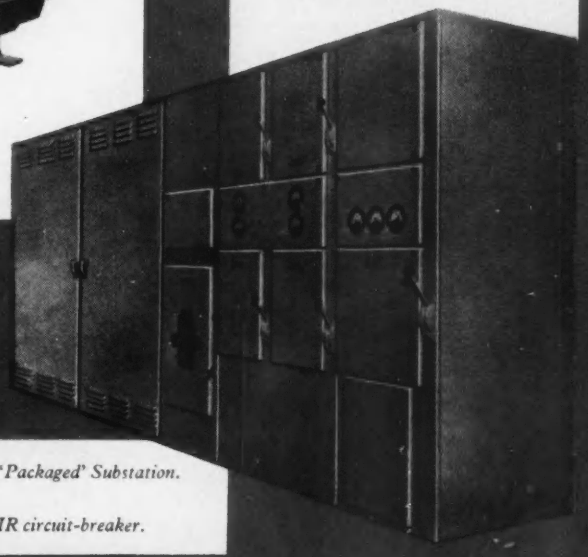
SWITCHGEAR LOGIC POINTS TO AEI



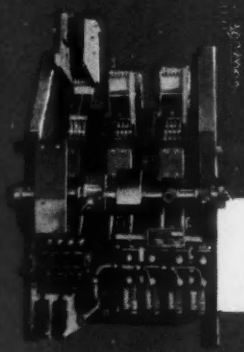
Core and windings of 500-kVA, 3-phase, 11,000/433-volt transformer.



Type CMC fuse switch unit.



The complete 'Packaged' Substation.



1600-amp Type AIR circuit-breaker.

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AEI design and engineering logic brings you all the commonsense advantages of 'PACKAGED' substations. These compact units look neater, save space and installation costs. Fire risk is eliminated because no oil is used in any part of the equipment. The risk of cable faults is reduced because of the solid interconnections within the substation. Inspection and maintenance are easier. All these are commonsense advantages for *your* next substation assembly.

Above is an arrangement of a 'packaged' medium-voltage substation. You can obtain further details of suitable units for your applications by contacting your nearest AEI office, or writing direct to the AEI Switchgear Division.

All AEI 'Packaged' Substations include:
Dry Type Class 'C' Insulated Transformer with capacity up to 1,000 kVA. An incoming Cable Box. A Type AIR medium-voltage air-breaker. Cubicle pattern 'CMC' fuse switch units with H.B.C. cartridge-type fuses.

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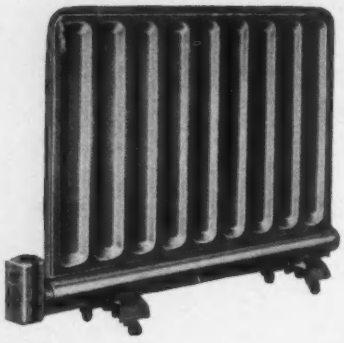

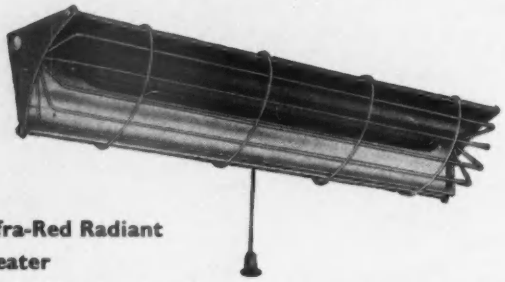

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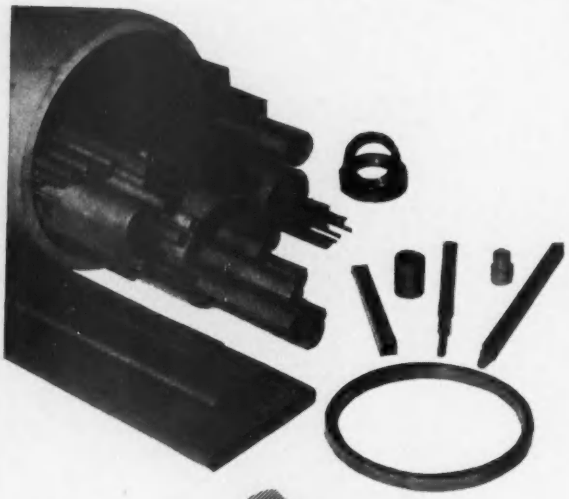

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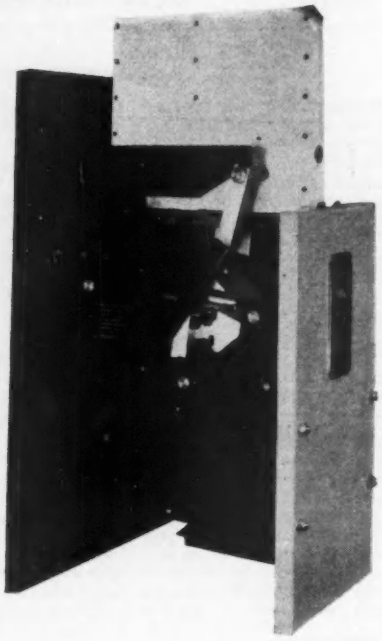

TYPE N.C.

(TO BSS 775 SR/11/D3/850 V)

STANDARD	RATING
CLASS II	MECHANICAL DUTY
MAKING	400%
RATING	2,000 and 4,000 A

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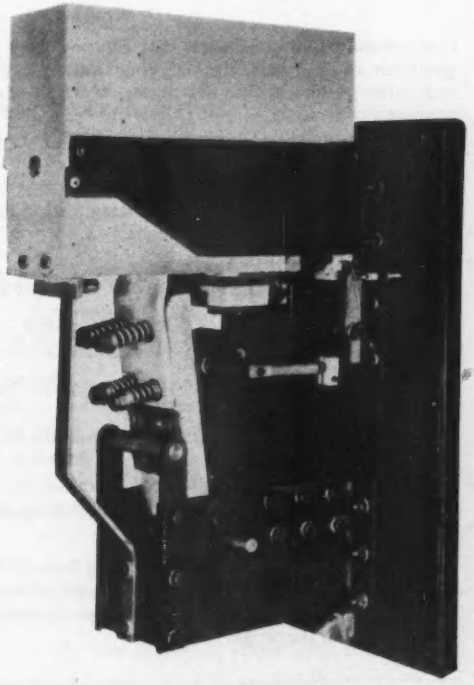

TYPE L.B.

(TO BSS 775 SR/IV/D4/750 V)

STANDARD	RATING
CLASS IV	MECHANICAL DUTY
MAKING	400%
BREAKING	400%
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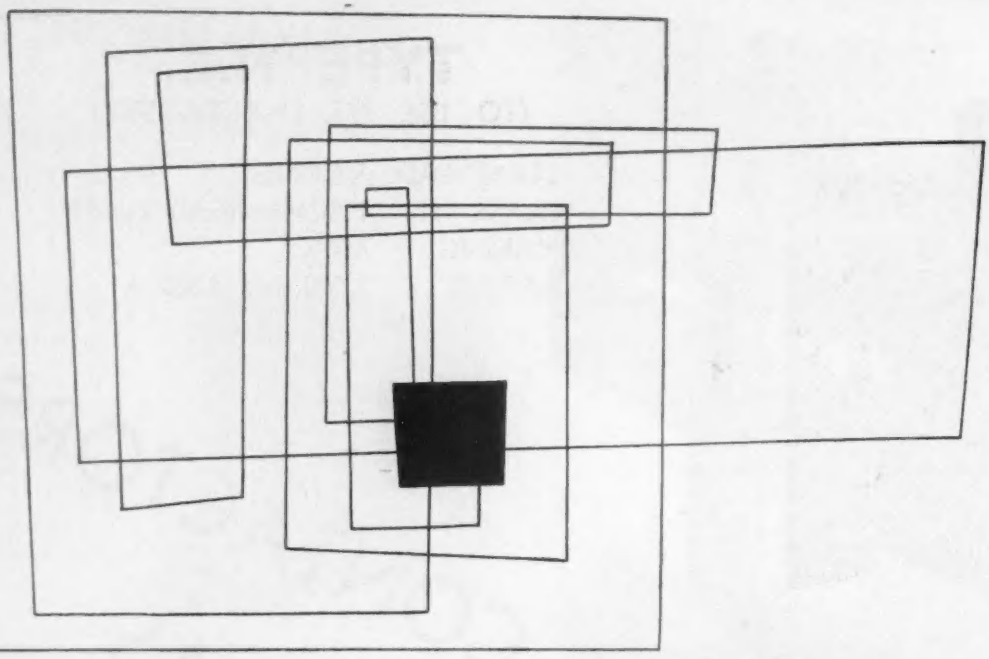
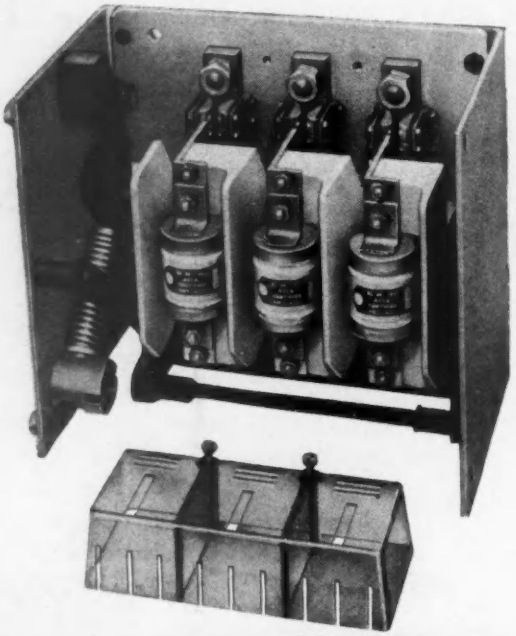


THINKING TECHNICALLY



One comes to the conclusion that Ellisons have given a great deal of thought to meeting your future requirements and have produced fuse-switchgear which is the most advanced of its kind.

It is safe, reliable, compact fuse-switchgear, easy to install and simple to maintain.

We are fortunate to have at our disposal our own A.S.T.A. authorised short-circuit testing station to further exploratory testing and *prove* designs.

In detail . . .

DESIGNED AND TESTED TO B.S. 3185:1959 for use with fuses tested to B.S. 88:1952, Category AC5.

SWITCH MAKING CAPACITY—46,000 amps. at 550 volts, ·15 P.F.

SWITCH BREAKING CAPACITY—3 times the rating at ·25/·3 P.F.

SWITCHBOARDS—Busbars and connections—comply with B.S. 159:1957.

FUSES—any make to B.S. 88:1952, Form B.

SEPARATE UNITS—Switch units supplied separately for mounting in your own switchboards.

Illustrated here is a switch unit removed from its housing. Self-aligning contacts of silver-plated copper permit closing for long periods without detriment. Finger contacts identical throughout the range.

RATED CURRENTS	
Fuse-Switch AMPS	Fused AMPS
100	2—200
200	2—400
300	2—400
400	350—500
600	350—600
Three-pole or three-pole and neutral link.	

ELLISON SWITCHGEAR

TRADE MARK

For further information and technical advice contact:

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893

THURSDAY 16 NOVEMBER, 1961
Registered as a Newspaper Volume 140 No. 20

Dans ce numéro

Téléindication des lectures des compteurs de kilowatts-heure 717

Si l'on fait répéter en un seul endroit toujours accessible les indications de tous les compteurs de kilowatts-heure dans un immeuble résidentiel, on facilite la tâche du lecteur de compteurs du service d'alimentation d'électricité, et on rend la lecture des compteurs moins coûteuse. Un des montages à cet effet se sert d'un accessoire sur un compteur de kWh normal, qui fournit une impulsion au compteur à distance toutes les fois qu'un kilowatt-heure supplémentaire est indiqué.

Essai non destructif 721

Certains documents présentés au cours d'une récente conférence décrivent des techniques pour l'essai non destructif—pendant la fabrication et plus tard en cours de service—d'équipements pour l'électrotechnique.

Soudage au faisceau électronique 727

La soudeuse au faisceau électronique est un nouvel outil pour l'ingénieur de fabrication. Le faisceau d'électrons fournit une surface de chauffage ayant une concentration au moins 5000 fois supérieure à celle d'un arc électrique. Le faisceau peut être concentré sur un point qui est le 1/10.000 ème de la plus petite surface réalisable avec toute autre méthode. Avec les nouvelles machines, on peut effectuer le soudage de tôles minces ou épaisses en métal ou en alliage ayant un point de fusion élevé; d'autre part on peut produire des trous ou des fentes ayant des dimensions égales à quelques microns.

Moteurs à induction à enroulement simple et à deux vitesses 738

Les moteurs à induction à enroulement simple et à deux vitesses peuvent actuellement s'obtenir ayant des débits de jusqu'à plusieurs centaines de chevaux, et une gamme très variée de vitesses. Ces moteurs appliquent le principe de "modulation d'amplitude des pôles" afin d'effectuer le changement de vitesse avec une commutation relativement simple.

In dieser Nummer

Fernablesung von Kilowattstundenzählern 717

Wenn man die Anzeigen sämtlicher Kilowattstundenzähler in einem Mietshaus an einem einzigen, stets zugänglichen Ort wiederholen könnte, so wäre die Aufgabe der von der Elektrizitätsbehörde ausgesandten Prüfer wesentlich erleichtert und das Prüfen von Zählern könnte dementsprechend verbilligt werden. Eine zu diesem Zweck vorgesehene Einrichtung verwendet einen am gewöhnlichen Leistungsmesser anzubringenden Ansatz, der bei der Anzeige jeder zusätzlichen Kilowattstunde einen Puls an den Fernzähler liefert.

Zerstörungsfreie Werkstoffprüfung 721

Methoden zur zerstörungsfreien Prüfung elektrotechnischer Geräte während der Herstellung sowie später im Gebrauch bildeten den Gegenstand von Beiträgen, die während einer kürzlich abgehaltenen Konferenz verlesen wurden.

Elektronenstrahlschweissung 727

Eine neues Werkzeug in der Fertigungstechnik bildet die Elektronenstrahlschweissmaschine. Der Elektronenstrahl liefert eine Heizquelle, deren Konzentration etwa 5000 mal stärker als die des Lichtbogens ist. Er kann auf eine Fläche gebündelt werden, die ein Zehntausendstel der kleinsten nach anderen Methoden möglichen Fläche beträgt. Mit diesen Maschinen können dünne und dicke, aus hochschmelzenden Metallen oder Legierungen bestehende Bleche geschweisst oder Löcher und Schlitze einer Ausdehnung von nur einigen Mikronen hergestellt werden.

Zweigeschwindigkeits-Induktionsmotore mit nur einer Wicklung 738

Es gibt jetzt Zweigeschwindigkeits-Induktionsmotore mit einer einzigen Wicklung, die Leistungen bis zu mehreren Hundert PS entwickeln und mit den verschiedensten Drehzahlbereichen hergestellt werden. Man verwendet bei ihnen das Prinzip der "pole-amplitude modulation", das Drehzahländerungen mit verhältnismässig einfachen Schaltvorgängen ermöglicht.

ELECTRICAL TIMES

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Telegrams: Equivolt . Estrand Telephone: HOLborn 6016

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by P. A. Ottmann, B.SC.(ENG.), A.M.I.E.E.

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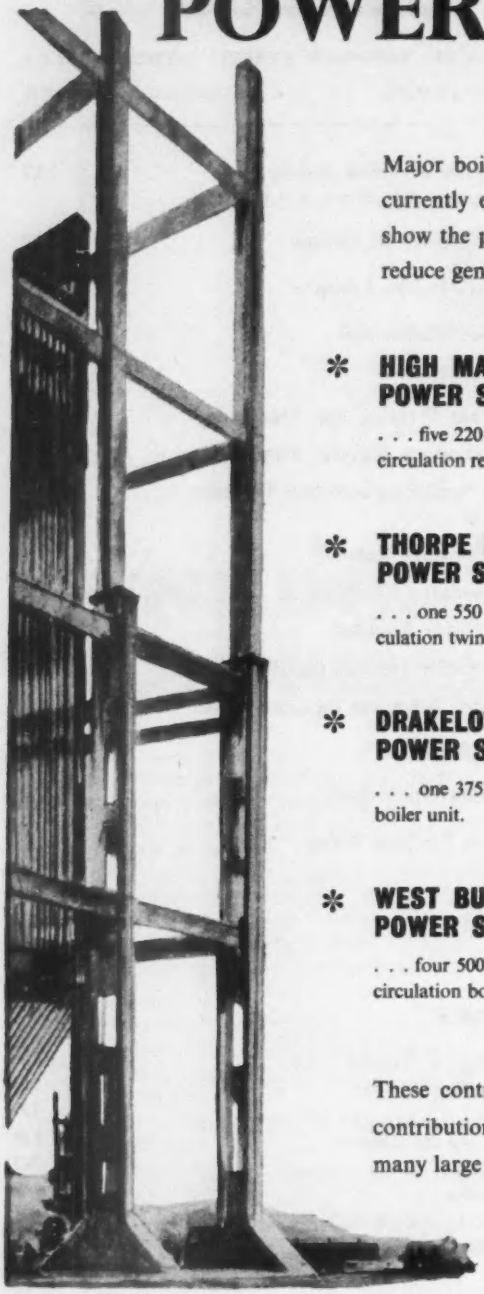
PROGRESS IN POWER PLANT DESIGN



Major boiler contracts in which International Combustion Limited are currently engaged for the Central Electricity Generating Board, clearly show the pattern of development adopted to achieve greater output and reduce generating costs.

	EVAPORATION	STEAM TEMPERATURE
✻ **HIGH MARNHAM POWER STATION**	1,400,000 lb/hr	1,060°F
. . . five 220 MW controlled circulation re-heat boiler units.	STEAM PRESSURE 2,450 lb per sq. in.	RE-HEAT TEMPERATURE 1,005°F
✻ **THORPE MARSH POWER STATION**	EVAPORATION 3,750,000 lb/hr	STEAM TEMPERATURE 1,055°F
. . . one 550 MW controlled circulation twin furnace boiler unit.	STEAM PRESSURE 2,400 lb per sq. in.	RE-HEAT TEMPERATURE 1,055°F
✻ **DRAKELOW 'C' POWER STATION**	EVAPORATION 2,500,000 lb/hr	STEAM TEMPERATURE 1,110°F
. . . one 375MW super-critical boiler unit.	STEAM PRESSURE 3,650 lb per sq. in.	RE-HEAT TEMPERATURE 1,055°F
✻ **WEST BURTON POWER STATION**	EVAPORATION 3,450,000 lb/hr	STEAM TEMPERATURE 1,055°F
. . . four 500 MW re-heat controlled circulation boiler units.	STEAM PRESSURE 2,400 lb per sq. in.	RE-HEAT TEMPERATURE 1,055°F

These contracts are significant stages in the International Combustion contribution to power supply in Great Britain, and are supported by many large overseas contracts and for nuclear power plant.

INTERNATIONAL COMBUSTION LIMITED

NINETEEN WOBURN PLACE, LONDON, W.C.1. TELEPHONE TERMINUS 2833
WORKS: DERBY

C.E.I.

ELECTRICAL TIMES

ESTABLISHED 1891

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Comment

N.I.C. GROWS IN TECHNICAL IMPORTANCE

The many bodies represented on the NICEIC heard of a successful year's activities when they met for the Council's annual general meeting last week. Statistically, the past twelvemonth has proved a record breaker, crowned by approval of the thousandth contractor additional to those taken over from the area board, ECA and National Register lists. The period has proved particularly encouraging in the number of one- and two-men businesses coming forward for inspection, since it is smaller firms which are least likely to reach NIC standards of work. But most significant was the emergence of the NIC as an initiating source for technical ideas in installation work. This has been particularly notable in the continuing debate on earthing, and especially in connection with the alleged shortcomings of earth-leakage circuit-breakers. The NIC finds itself in an unequalled position for collecting the statistics that can test the strength of a case for a change from existing practice, and also well placed to obtain representative opinions on the form any such changes might take. So far as earthing is concerned, the Council may become even more important, if Sir Robertson King's authoritative predictions prove correct. Speaking at a luncheon following the NIC's a.g.m., he referred almost scornfully to the present attitude of area boards to the earthing of consumers' installations. He hinted strongly at Government action if the industry did not itself take steps to improve the standard of earthing. In this field, the NIC provides valuable common ground between most of the interests directly involved. It should be able to point an acceptable solution, leaving the boards to find an administrative framework for implementing it.

ACADEMIC WINDING

Demonstrations of unusual electrical machines in sizes as large as 800 h.p., only three years after publication of the basic idea they incorporate, is a creditable performance. This is the achievement with the pole-amplitude modulated two-speed induction motor evolved by Professor Rawcliffe and his collaborators at Bristol University. It is a development from an academic idea into a practical design that has an added interest because many difficulties that seemed self-evident in the light of electrical engineering experience disappeared when practical trials were made. Worries about noise, vibration and poor accelerating properties, all related to the unfamiliar way the stator windings are treated to obtain speed changing, have proved unfounded. One of the large industrial groups that have taken up the development now state that their policy is to offer pole-amplitude modulated

machines wherever their use results in the most economic arrangement backed by adequate performance. Moreover, the fundamental idea is showing itself capable of extension in encouraging ways, such as using the lower speed as the basic speed, in applications when some small drop in h.p. at the higher speed can be tolerated. In the course of this expeditious progress, the interest of the National Research Development Council has been apparent. That interest is to be seen as well in other motor ideas which have sprung essentially from the universities, and which seem destined for successful industrial development: the linear induction motor and the spherical motor. In all three cases academic questing has probed practical possibilities which were obscured by a tough but penetrable layer of essential difficulty. The NRDC has catalysed the process by its willingness to invest money and its ability to interest likely industrialists.

EASIER METERING

Metering the supplies to large blocks of flats is readily enough carried out on conventional lines. But is the meter reader's visit to every flat for perhaps 16 storeys up really necessary? Availability of relatively simple devices for repeating meter readings at a distant point indicates a way out. However, as the author of the article that begins opposite makes clear, the price is likely to be considerable, when cabling is taken into account as well as the remote indicating apparatus. Is it worth spending about £7/service in order to save the difficulties of estimated meter readings and subsequent correspondence with disgruntled consumers? Quite possibly not, the more so in view of the considerable success that seems to be attending the use of estimated readings every other quarter in some areas. But there is one proviso in this respect. A heavy electricity account undoubtedly has a strong anti-promotional effect. Moreover, growing loads mean that metering costs can be increased without their representing a greater proportion of revenue. If more frequent meter reading became practicable at relatively low cost through centralised grouping of meters in always-accessible positions, then accounts on a monthly rather than a quarterly basis might become a possibility. Such a change would be a reversal of the present trends of metering practice in area boards, but it would make increased use of electricity apparently less painful on the pocket. But for that move to become possible, still more centralisation of readings would probably be needed, perhaps repeaters at substations, or even the American dream of telephone-lined indication-on-demand to the central accounts office.

EXTENDING THE ROUTINE TEST

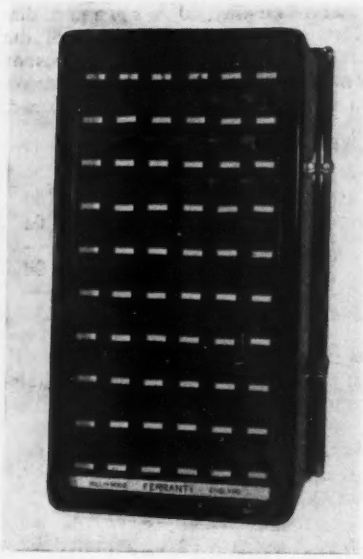
Non-destructive testing occupied the attention of a large audience during last week's three-day conference organised by the IEE. Electrical engineers are accustomed to tests which, they accept tacitly, will not affect the serviceability of the equipment tested. As a result, the affixing of the particular label comes unfamiliarly to the non-specialist. Indeed, where insulation is concerned, it does not require a great deal of ingenuity to devise proving tests that are non-destructive, so long as the equipment is satisfactory. The need for a more special approach comes when it is desired to set some rational limit of acceptance or rejection for a quality like insulation resistance, which can change over a wide range. Again, it arises when it is necessary, as in development work, that a failure under test should not involve loss of the evidence in the catastrophic sequence of breakdown. The overall impression from the papers presented in abstract to the conference is that electrical techniques have made far more impressive contributions to the testing of mechanical properties than they have in any non-destructive way to the check of electrical quantities. There is nothing of exclusively electrical application to match in significance of ultrasonic testing as a recent development, or of the wide field of radiography over the years. Probably the nearest approach comes in the discharge detection techniques which give warning of incipient breakdown in dielectrics. These can be of vital importance in extending the range over which manufacture of plastics-insulated cables can be attempted with hope of economic success.

NUCLEAR ENGINEERING CONTRIBUTION

The development of nuclear engineering has brought plenty of problems for engineers generally, some new techniques in control and in structural engineering, and a number of new materials whose development costs have been met only because they were essential to nuclear progress. Has it contributed anything more basic to the engineering scene? Dr K. J. Wootton, of the United Power Company, makes a surprisingly broad claim in a lecture he delivered earlier this week to the ASEE. He considers that exploitation of nuclear energy has brought a significant development of the scientific approach to engineering design. In this context, scientific approach seems to mean thinking-through a problem from first principles each time, instead of starting from the handbooks and standard design codes and extrapolating from there. In some of the more exotic regions of nuclear design the claim can probably be made out. Once the exhilaration of the completely new look at a problem has been experienced by an engineer he is likely to seek to apply it to other fields of activity. Yet a pause for consideration may be advisable. The old tag about engineering being the art of doing a job at half the cost nags insistently when the merits of the *ad hoc* approach are urged. Standard practice will always meet a number of situations which it cannot deal with; but within its proper limits it is such a saver of time and effort, that it is likely to be a money saver too, even though the resultant design does not represent the ultimate currently practicable.

Meteor

This week's quick summary of electrical news faces advertisement page 20



Remote repeating of meter readings

by P. A. Ottmann, B.Sc.(Eng.), A.M.I.E.E.

The author shows that for 5 gn to 7 gn, credit meters in flats and houses can be adapted to give remote indication at a point accessible at all times to the meter reader, thereby saving staff, accounting time and money

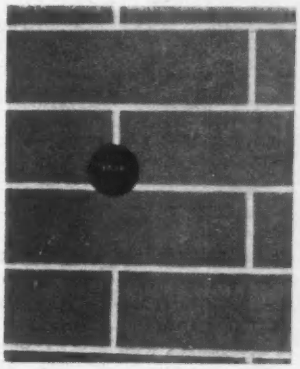


Fig. 1. Above left: A 60-unit repeater suitable for conveniently recording meter readings in a block of flats

Fig. 3. Right: Repeater unit for single house service meter showing its inconspicuousness on a brick wall

ONE result of the changing pattern of domestic life in towns and cities, when the husband and often the wife are away from home for many hours, is that access during the day for meter reading is practically impossible. Under these conditions, and until such time as the electricity authority is prepared to supply electricity to consumers based on some system as at present used by the water department or the local authorities, the question of reading the meters which register consumption of electricity in dwellings, especially in multi-storey blocks of flats, will become more difficult and costly to the area boards. To reduce the cost of meter reading and to make life easier for meter readers by reducing the amount of climbing they have to do in multi-storey blocks and dwellings, consideration should be given to the installation of remote repeaters which show the meter reading.

Types of Repeating Meter

Several meter manufacturers have developed equipment to give reliable and accurate registration of meters from a remote position, which is accessible at all times to the meter reader.

One manufacturer has arranged for the meter counting train to be fitted with a single bar commutator which makes contact alternately with an upper and a lower brush (Fig. 2). These brushes are connected to a double half-wave rectifier, the centre point of which feeds the working coil of the remote register, first with a positively and then with a negatively polarised pulse. The circuit is completed through an auxiliary supply transformer and the feed brush of the commutator. The remote register mechanism is polarised and moves a pawl that advances the numerals half a unit per impulse. The advantage of this type of mechanism is that spurious impulses arising from a dirty or otherwise defective contact cannot advance the counter, as a definite reversal of polarity is necessary for each operation. Other manufacturers arrange for the meter counting train to be fitted with a light pair of contacts that close for a short time as each unit is consumed. The remote register consists of a standard pattern telephone call counter, arranged for operation at 240 V 50 c/s by means of its own bridge rectifier and series resistor. This unit is connected in series with the meter contacts, and to the supply terminals inside the meter case. Thus, each time the contacts close the remote register advances one unit. Such a system is employed in the Ferranti equipment.

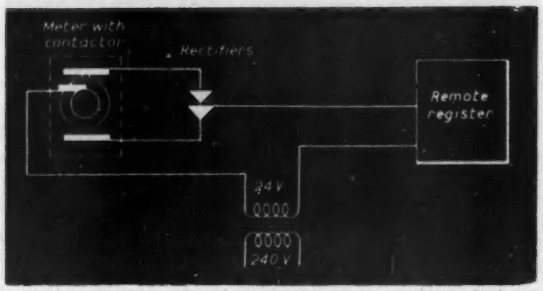


Fig. 2. A simple commutator in the supply meter gives alternately positive and negative pulses which are transmitted to the remote register. Each impulse advances the register half a unit

The repeater register enables meter readings to be taken on a domestic supply without entering the premises. It is easily installed, inconspicuous and requires a minimum of maintenance. The repeater is fixed in a suitable position on an outer wall of the house, and is operated by electrical impulses received from the standard house service meter to which a contacting device has been fitted. Impulses are transmitted at the rate of one for each kWh or 10 kWh registered, the total advance being shown on a four- or five-digit cyclometer.

This low rate of impulsing imposes an extremely small mechanical load on the meter so that its accuracy is not affected, and no auxiliary power supply is needed because the repeater operates on 240 V a.c. from the incoming mains. The current required is of the order of milliamps so that two pilot wires are all that is necessary between meter and repeater.

The meter, which is installed in the usual position, is the standard house service pattern. It is fitted with a pair of silver contacts mounted behind the register and operated by a nylon cam on one of the register spindles. Because of the low current the contacts are small and the quick-

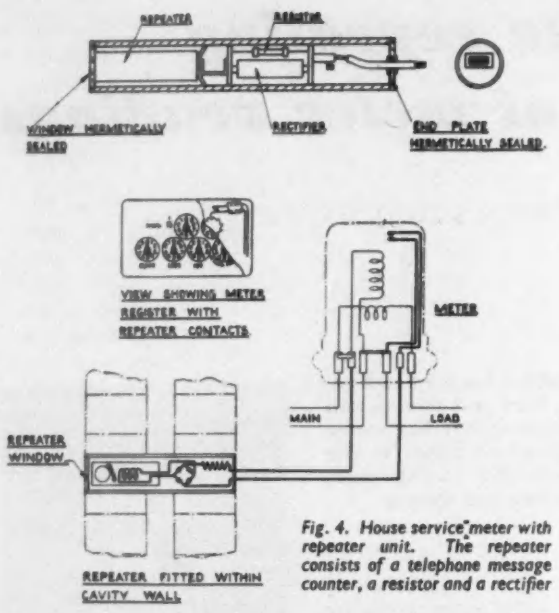


Fig. 4. House service meter with repeater unit. The repeater consists of a telephone message counter, a resistor and a rectifier

make-and-break action ensures long, trouble-free service. Connections from these contacts are taken to two extra terminals in the meter terminal block and do not affect the fixing centres or the main terminal centres which are in accordance with B.S. 37, Parts 1 and 2, 1952.

The repeater unit (Fig. 4) consists of a telephone message counter, a resistor and a rectifier mounted inside a synthetic resin-bonded paper tube. It operates on d.c. obtained through the resistor and full-wave rectifier from the incoming supply. The tube diameter is $1\frac{11}{16}$ in. and its length is 11 in., and it is therefore suitable for the width of a conventional cavity wall. On the outside wall, a hermetically sealed window fits flush with the brickwork, giving ample protection from weather and unauthorised interference while ensuring that the counter can be easily read. A brass ferrule, $3\frac{1}{2}$ in. diameter, is screwed to the wall inside the house, and the pilot wires emerge through a hermetically sealed gland. The exterior view is shown in Fig. 3.

Remote Reading Economics

What of the economics of the installation? The remote metering equipment per meter varies in price from £3 5s to £7 7s. Those manufactured by Messrs Ferranti Ltd., incorporating the well-proven GPO counters, can be relied on to last the life of a building, that is, 50 or more years. The price of the units are given in Table 1.

Consider an installation in a 16-storey block (Fig. 5) of 90 flats with six flats per intermediate floor, and each flat equipped with off-peak floor-warming. The estimated cost of supply and installation for remote metering equipment at each supply intake position incorporating the necessary wiring, might be as follows:

3,000 yds of 2 pair 1/0·024 sq in. tinned copper conductors, 240 V, p.v.c.-insulated cable at £35 per 1,000 yds	£105
Labour for installation and to erection ...	£57
	£162

Average cost per meter 18s

A further example is a nine-storey block (Fig. 6) of 36 flats with four flats per floor, each flat equipped with off-peak floor-warming. The internal supply distribution in the block is arranged so that a four-way, 60 A, s.p. and n. distribution board is fixed at each landing to control the supply of the four flats on each floor. The estimated cost of supply and installation for remote metering equipment on each landing adjacent to the four-way distribution board, including the necessary wiring, might be as follows:

500 yds of 2 pair 1/0·024 sq in. tinned copper conductors, 240 V, p.v.c.-insulated cable at £35 per 1,000 yds	£17 10s 0d
Labour for installation and to erection	£27 10s 0d
	£45 0s 0d

Average cost per meter 12s 6d.

Cost of Modified Meters

The total extra cost per meter if remote metering equipment is provided for the 16-storey block amounts to:

Cost of remote metering equipment using Ferranti 60-unit register ...	£5 3s 4d
Cost of adapting standard quarterly single-phase meter to operate with the remote register	£1 4s 6d
Cost of installation	18s 0d
Total	£7 5s 10d

Say £7 7s total.

In the case of the nine-storey block, the cost of remote metering equipment would be:

Ferranti four-unit registers	£3 5s 0d
Cost of adapting standard quarterly single-phase meter to operate with the remote register	£1 4s 6d
Cost of installation	12s 6d
Total	£5 2s 0d

Say £5 5s total.

Table I. Cost and size of register units.

Type of register	Overall size of register; inches	Price per unit	Price of register per meter
Single-unit	$1\frac{11}{16}$ dia × 11	£4 4s	£4 4s 0d
Four-unit	7·6 × 2·6 × 5	£13 0s	£3 5s 0d
60-unit	21 × 10 × 9·5	£310 0s	£5 3s 4d

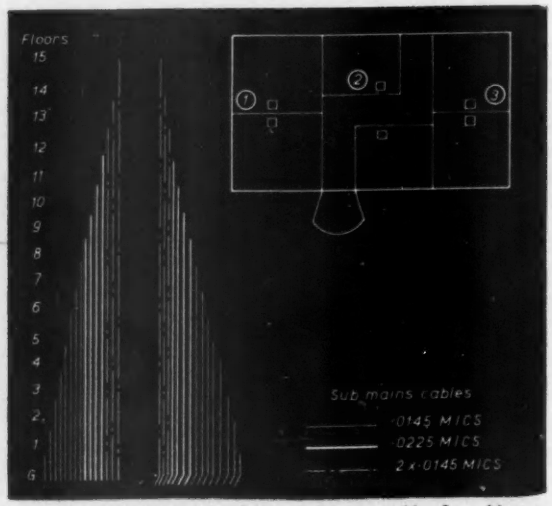


Fig. 5. Internal distribution of rising sub-mains cables for a 16-storey block with 90 flats. The typical floor plan shows the three service positions and the rising main ducts

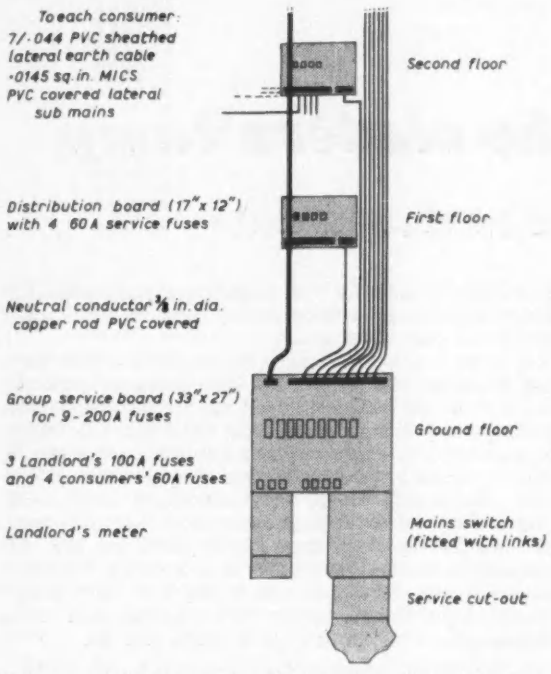

To each consumer:
7/·044 PVC sheathed lateral earth cable
·0145 sq. in. MICS PVC covered lateral sub mains
Distribution board (17" x 12") with 4 60A service fuses
Neutral conductor ⅜ in. dia. copper rod PVC covered
Group service board (33" x 27") for 9 - 200A fuses
3 Landlord's 100A fuses and 4 consumers' 60A fuses
Landlord's meter
Second floor
First floor
Ground floor
Mains switch (fitted with links)
Service cut-out

Fig. 6. Internal distribution system of rising mains and lateral sub-mains cables for a nine-storey block with 36 flats. The rising mains extend up for nine floors including the ground floor. The sheath of the rising main cable, one-core 0·06 sq in., is at earth potential and the sheath of the lateral sub-main, one-core 0·0145 sq in., is at neutral potential

It should be noted that the installation cost for remote cabling is based on the assumption that the cable would be installed with the rising and lateral sub-mains cables to each dwelling.

The additional capital expenditure for remote repeater meter equipment would be offset by savings in the cost of meter reading expenditure by:

1. The assurance that the meter reader will be able to obtain 100% of the readings he is required to do each day, whereas at present a reduced number, up to 30% below his target, only may be obtained.
2. No correspondence or duplicate calls to consumers whose meters cannot be read during normal working hours.
3. No necessity for meter readings to be estimated for some quarters when meter readers are unable to obtain the necessary information on their first visit.
4. Elimination of the mounting correspondence and the consequent manpower to deal with consumers' complaints when they dispute their quarterly consumption accounts.

Grouped Meters

Another method of reducing the costs of meter reading could be by grouping meters at the supply intake position in multi-storey blocks of buildings. Space would be required to house the meters, and as developers are not over-generous in supplying accommodation to Area Boards for intake supply equipment, a problem might arise. If the Boards are fortunate enough to persuade developers and local authorities to install off-peak floor-warming in blocks of buildings, then they might be expected to duplicate their internal distribution cables. This would mean increasing the cost of the distribution system for each block of dwellings and in some cases almost doubling it.

From available figures, the cost per dwelling for internal distribution cables including the service intake panels amounts to approximately 15 gn for a nine-storey block, while for a 16-storey block it is nearer 22 gn. The cost of the service intake panel/dwelling for the nine-storey block is of the order of 5 gn and that for the 16-storey block 7 gn. These costs are based on one supply cable to each dwelling, a standard rate meter and also an off-peak meter installed above the consumer unit in each dwelling. With these arrangements, the local authority is responsible for the supply and installation of wiring and control equipment for the off-peak floor-warming installation. If provision is made for group metering at the supply intake position, the local authorities may expect the Board to meet the cost of standard rate as well as off-peak rate supplies within multi-storey blocks.

In the opinion of the author, with the installation of remote repeating meter reading equipment, a Board's capital expenditure could be increased by 5 gn to 7 gn; instead of 10 gn to 15 gn if the internal distribution cables have to be duplicated to obtain similar meter reading facilities.

Finally, one other point needs to be considered. With the increasing use of electricity, which Area Boards welcome, consumers will have larger quarterly accounts to meet. Under present circumstances many consumers have difficulty in meeting their quarterly commitments and request the installation of prepayment meters to replace the standard quarterly meter. The capital cost of supplying and installing this type of meter, and the expenses incurred in the collection of the revenue, is much heavier than that for a standard rate meter.

By using remote repeating meter reading equipment, the electricity authority could render its accounts bi-monthly or even monthly, thereby restricting the ever-increasing heavy expenditure on prepayment meters.

The author is grateful to Messrs Ferranti Ltd. for the use of photographs and information in connection with the repeater units.

Nuclear Contributions to Design

DESIGN development associated with nuclear reactors has made important contributions to engineering generally. This is claimed by Dr K. J. Wootton (United Power Co.) in a paper presented on Tuesday to the ASEE. The greatest advantage, he suggests, is development of a scientific approach to engineering design. What he calls "rather uncritical" use of handbooks, codes, simple formulae and rules of thumb he considers still all too common, although perhaps not quite so prevalent in the UK as on the Continent.

When engineers came to design reactors, they found that they were beyond the bounds of standard practice, and that the materials they had to use were quite unlike those they were accustomed to. A completely new approach to engineering design was called for. Some of the problems that still arise are such that only original thinking from first principles is likely to bring a solution.

Activity in nuclear design has been particularly effective in bringing into use new and improved engineering materials. For instance, as a result, in part, of nuclear requirements, world output of niobium minerals has increased from five tons in 1930 to 5,000 tons in 1955. Beryllium is another metal receiving increased attention as a result of nuclear developments. Carbon has been closely investigated and non-destructive testing techniques have also received increased attention.

Fittings for the modern lamp

EFFECTS OF TEMPERATURE ON REQUIREMENTS

LAMP miniaturisation has received singularly little attention and it is not known how small a good lamp can be. In concluding his paper, the first of three presented to the Illuminating Engineering Society dealing with the effect of lamp temperature on fitting designs, Mr A. G. Penny added that fitting design had always been much restricted by the size of the light source. Reduction in size, although important from the cost point of view, was also justifiable from the viewpoint that there was little to be gained by making anything unnecessarily large. Earlier in his paper, "Changes in the Dimensions of Incandescent Filament Lamps," Mr Penny had traced development from the hand-blown, vacuum lamp with a carbon filament to the improvements made possible since 1954 by the development of capping cements able to withstand temperatures exceeding 200°C. He commented that some of the early designs of carbon filament lamp were remarkably small for their wattage. For example, one 65 W lamp was 2¼ in. dia. and 3¾ in. overall, whereas the modern 60 W lamp was 2⅜ in. dia. by 4¼ in. overall. Heat dissipation in the early vacuum lamps was about 92% by radiation and 8% by conduction through the supports. The introduction of the gas-filled lamp altered the heat dissipation process considerably, up to 19% being dispersed by convection in the gas. The pear-shaped bulb was developed to protect the cap from the additional convected heat. The introduction of machine-blown bulbs prompted a standard range of bulbs and this in turn caused a period of stability in lamp sizes with only slight tendencies to develop smaller lamps between 1932 and 1952.

Subsequent development in filament lamps was strongly influenced by the belief current in the 1930s that they would give way to the discharge lamp, and only in the last ten years has it been appreciated that the filament lamp will remain an important factor in lighting. As a consequence, further changes in the filament lamp should now occur.

Further standardisation could be expected since importers and exporters are demanding lamps which are interchangeable irrespective of their country of origin, yet which are able to hold their place in an intensively competitive and international market.

Standard 100 W Lamp for Heating Test

The second paper, "Standard Heat Test Lamps for the Temperature Testing of Lighting Fittings," was presented by Messrs J. N. Bowtell and J. R. Coates. They pointed out that the trend to smaller lamps had two consequences: that existing fittings could now be used with lamps of higher wattage ratings than those for which they were designed and that the higher temperature of the lamp cap caused temperature rise in such components as the cable and the lampholder above the general temperature increase due to the greater wattage rating of the lamp.

To prevent a continuation of this trend, they suggested that fittings should be marked with the maximum designed lamp wattage rating and that the temperature of lamp cap should be limited. They say it would then be possible to formulate rules for the temperature performance of lamps and fittings without unduly restricting the possibilities for their development.

It follows that, to ensure a fitting complies with these requirements, some form of test lamp should be available. A suitable lamp designated SHT has been developed and, although only in limited use, those concerned with fittings feel it will prove satisfactory as a test device although it is subject to some inaccuracies. The lamp is rated 100 W and it has a bulb size of the smallest GLS lamp of this rating likely to be developed for some years to come. A value for cap temperature rise of 160°C has been put forward to the IEC and CEE as a basis for discussion between those concerned with fitting and lamp design. This temperature is about 10°C higher than those measured on a batch of GLS lamps in free air.

Holder and Cable Heating

The third paper, entitled "Temperature and Temperature Variability in Lighting Fittings for Filament Lamps," by Joan Keen and H. F. Stephenson, described investigations on nine 100 W fittings selected to be representative of domestic, commercial and industrial types used with GLS lamps and with the standard heat test lamps. The paper discusses in some detail the results of the temperature tests which were made by thermocouples attached to the fittings. Considering the effect on lamp caps, the paper states that on three of the fittings tested the caps attained 190°C, while one fitting attained 200°C. The SHT lamps produce cap temperatures up to 230°C, suggesting that a number of fittings proved satisfactory in service would be rejected by this test.

In testing the contact parts of the holder it was found that the spring temperature in the plunger was only a few degrees above the terminal temperature. Terminals on the lamps tested were below 135°C, the maximum operating temperature for phosphor bronze, on only one fitting. Higher values were recorded with the SHT lamp and, if these are considered, more than half the fittings would require springs of special steels able to operate at up to 200°C.

Another important factor investigated was the temperature of the connecting cable. The most vital point was considered to be the bifurcation between the conductors. The paper states that experience has shown a temperature rise of 85°C to be permissible here, although it is higher than the figures normally quoted for rubber and p.v.c. Temperature rises in the fittings tested with 60 mm lamps varied between 50°C and 65°C in five of the fittings, but in the remainder they were between 80°C and 120°C, so that even with the limit of 85°C, four of the fittings tested would have needed heat-resisting cable. Tests with the SHT lamps showed only one fitting to be satisfactory without heat-resisting insulation. The paper analysed many other factors investigated and included an appendix showing heat distribution in the various types of fitting tested.

Testing without destruction

I.E.E. SYMPOSIUM ON INSULATION, JOINTS, AND MATERIALS

THE adoption of high factors of safety in engineering design is universally admitted as a confession of ignorance as to the true properties of the materials or the conditions under which they are to operate in service. Ever since the first mechanical appliance was devised by man, he has endeavoured to learn more about the materials and how to apply them with the maximum of economy and the minimum of hazard in ultimate service and, as his knowledge has expanded, so has he been able to reduce the safety factor. His methods have been first, to test materials to destruction and to apply the results to the design of components; secondly, to test individual components or whole assemblies to destruction and, finally, to apply proof tests, below the estimated breakdown load but well above the expected service load, to each part or assembly before it goes into service.

There has still remained a lingering doubt that the proof tests themselves may constitute a hazard in that they over-stress and weaken the product before going into service, particularly when, as in the case of insulation components in switchgear, the proof test may be applied several times in succession at different stages of construction. As a result, there has risen a movement for the examination of methods which will enable products, both mechanical and electrical, to be proof-tested without any possible chance of harming them, and so the concept of non-destructive testing was born.

Throughout the country, scientists and research workers formed study groups, associations and societies for the furtherance of the work and, early in 1957, the Joint Committee for Materials and their Testing of the Institution of Mechanical Engineers was approached with a request to form a body for the joint study of the subject. In July the British National Committee on Non-destructive Testing was formally created with Mr C. H. Stanger, A.M.I.C.E., as chairman. Since it was apparent that the subject vitally concerned electrical, as well as mechanical, engineering, in November, 1959, the IEE was approached and plans for a symposium of papers laid down. The work was jointly shared between the Measurement and Control Section of the IEE and British National Committee—whose chairman this year is Dr L. Mullins, F.R.P.S., M.SC., A.I.M., F.INST.P.—and, on Wednesday last, the three-day symposium was officially opened by the president of the IEE, Mr G. S. Lucas, O.B.E., F.C.G.I., M.I.E.E.

The symposium was attended by some 400 delegates, including 16 from overseas, and 44 papers were presented, for the most part by rapporteurs to give the longest time for discussion, each dealing with some aspect of electrical testing. Discussions on the papers will be reported next week.

The opening lecture was given by Dr R. W. Sillars, B.A., PH.D., M.I.E.E. In it he surveyed the broad field which could be encompassed by the study of non-destructive testing methods in the electrical sphere which could broadly be covered by three methods of incipient breakdown detection: electric, magnetic and by odour. Magnetic methods could be dismissed since they applied only to the magnetic fields of equipment which, in any case, were not affected by electrical breakdown. Odour was often an early indication of electrical breakdown, but whereas the sensitivity of the human nose was high enough to detect odoriferous vapours as rare as one part in a million, or even ten million in some cases, no electrical device could get anywhere near that sensitivity. That left electrical methods, which included electronic devices, and here the field was wide indeed.

Dr Sillars then went on to outline some of the methods which were to be described and discussed during the symposium and their significance in electrical design of the future. He put significant stress on the studies into discharge erosion as a contributory cause of insulation breakdown, and also on the work being done to establish the effects of water on the dielectric properties of oil.

Routine testing during production came well within the scope of non-destructive methods since the product must emerge unharmed, yet adequately insulated. Two methods would be described; one on the continuous discharge testing of extruded cables and the other one the enamel coverings of wires. Other methods applicable to wire and cable manufacture monitored the thickness of the insulation, eccentricity of core during manufacture and the detection of gas leaks in pressurised cables.

Vibration and dancing on overhead lines introduced severe mechanical fatigue which could result in the breaking of strands, while "galloping" in high winds could cause conductors to touch. Papers on these subjects would also be given.

A vote of thanks was proposed by Mr W. S. Elliott, M.A., chairman of the Measurement and Control Section of the IEE, who gave an amusing instance of destructive testing. A friend submitted a nylon climbing rope to the Swiss testing authorities with the request that it be tested before he used it. The report came in due course that the rope was excellent. Reassured, he asked for its return. In a few days it arrived—cut into lengths of about 6 ft.

The organising committee for the conference included Messrs H. L. Carson, P. M. Hollingsworth, A. C. Lynch, R. Main, A. Nemet, L. Roullier, E. G. Standford and R. S. Vincent. The chairman was Mr. C. G. Garton.

A selection of the papers are summarised in the next pages.

SYMPOSIUM PROGRAMME

Session 1.	*Chairman:* The President I.E.E.
Session 2.	PROPERTIES OF MATERIALS *Chairman:* C. G. Garton, M.I.E.E.
Session 3.	COMPONENTS *Chairman:* Dr. L. Mullins, F.R.P.S., M.Sc., F.Inst.P.
Session 4.	CABLES *Chairman:* D. B. Irving, B.Sc., M.I.E.E.
Session 5.	DETECTION OF CONCEALED FEATURES *Chairman:* A. C. Lynch, M.A., B.Sc., M.I.E.E.
Session 6.	CONTACTS AND JOINTS *Chairman:* Dr H. G. Taylor, D.Sc., M.I.E.E.
Session 7.	VIBRATION *Chairman:* Dr H. G. Taylor, D.Sc., M.I.E.E.

Discharge Erosion of Insulation

TWO papers of some importance to manufacturers of large, high-voltage generators, dealt with aspects of insulation testing on stator windings. J. L. Douglas (CERL), in his paper "Measurement of Discharges in Generator Stator Insulation" discloses that investigations on a number of stator failures in this country have established discharge erosion as the main cause of premature insulation breakdown. Methods of detecting discharges in voids within solid dielectrics have been applied including the use of the ERA discharge detector. The weakness of this method lies in that it cannot discriminate between a single large pulse or the integrated summation of several smaller discharges. A new detector has, therefore, been developed in which sensitivity is sacrificed to achieve better resolution since the main interest is in large discharges. Measurements on complete stator windings confirm the presence of genuine large discharges which are presumed to occur in the voids between the outside of the stator insulation and the slot walls. Other tests, however, fail to discriminate between the discharge magnitudes on new and old insulation and it is concluded that, though the proposed method of counting discharges in small samples or on individual stator bars has several advantages over existing methods, there is as yet no non-destructive test which will give an indication of insulation deterioration through discharge erosion.

In the paper, "Non-destructive Electrical Test Methods for Evaluating High-voltage Stator Bar Insulation," J. S. Simons and M. T. Richards (AEI (Rugby) set down the requirements for a satisfactory non-destructive test and compare them with those of previously recommended methods. They suggest that low-voltage a.c. capacitance and loss-tangent measurements over a range of frequencies could usefully be exploited as a means of obtaining information on the state of solid insulation. These measurements can also be used to detect presence of unremoved solvents from the mica bonding agents and it can be shown that ageing of micaceous insulation may be determined by the loss tangent/frequency characteristic, providing that the bonding material is known. High-voltage a.c. measurements are necessary for the detection of voids, but it is felt that high-voltage d.c. testing has little significance in relation to insulation behaviour at power frequencies.

A new bridge method of more rewarding performance than the conventional Schering is described in which an oscilloscope serves the dual purpose of a null detector and as a means of estimating the discharge energy/cycle from the measurement of the enclosed area in a charge/voltage loop trace.

INSULATION AND APPLICATION

THOUGH there is a wealth of data to call upon in relation to the behaviour of many basic insulating materials, it cannot always be applied to asemblies since the results are greatly affected by the manner and conditions of application. Then there are new materials, many of a synthetic nature, which are constantly coming forward and have to be evaluated before they are incorporated in design.

When it comes to ageing, the effects of corrosive atmospheres or other aggressive conditions, the methods to be applied must be, to a large extent, of a non-destructive nature or the tests will come to a premature conclusion. In his paper, "The Evaluation of Insulation Systems to Determine Life in Service," A. C. Cameron (Brush Electrical) sets out to underline the difficulties which may be encountered in an early electrical evaluation and warns that certain synthetic resins require several weeks of exposure before becoming stabilised. The test programme must, therefore, be of many thousands of hours' duration. Even when the test results have been analysed statistically and performance curves produced, the information may be misleading when applied to the material in association with a bonding agent.

Polyester-terephthalate film aged at 130°C for 10,000 hr shows only slight deterioration but, when coated with certain adhesives or laminated to backing materials for class E machine slot liners with these adhesives, the film degrades rapidly at the same temperature.

Within certain limits, valuable information of the behaviour of insulation in service can be obtained from scale model assemblies of production designs. Simple to construct, they can be stressed electrically or mechanically and submitted to high temperatures, corrosive atmospheres or fluids. "Motorettes," which simulate sections of wound stators, have been used with success and have even been subjected to intense nuclear radiation to establish their capabilities for high ambient temperature radioactive locations.

Technical results achieved by such methods must then be duplicated on full-scale models or prototypes, so as to establish the correct scaling factor from which subsequent scaled-down tests can be properly related to actual conditions.

Though occasionally it is possible to subject equipment to long period full-load running on sites where periodical checks and measurements can be taken, a more satisfactory laboratory procedure for rotary machines is to subject them to continuous cycles of reversals at suitable time intervals, thereby raising the temperature in the windings to maximum design levels and, at the same time, apply severe mechanical shocks.

Non-destructive Breakdown of Oil

IN conventional forms of breakdown test on transformer oil, the small quantity in the test cell can be sufficiently carbonised by the failure, at either r.m.s. or impulse voltage, to invalidate further tests on the sample. In order to investigate a means whereby such test voltages could be applied without harming the oil, a method of limiting the energy in the discharge has been developed and was described by W. P. Baker and P. Reece (AEI (Manchester) Ltd.) in their paper, "Non-destructive High-voltage Impulse Testing of Transformer Oil." Briefly, the test cell is placed in series with a capacitance of comparable value and the impulse applied across the pair. The voltage is distributed across the two capacitances in inverse proportion to their values and, on breakdown of the oil gap, the carbonising energy will be limited to that required to raise the voltage of the series capacitor to the impulse value. This, of course, can be made exceedingly small by reducing the size of the series capacitor, but then the total voltage of the impulse generator will need to be raised.

In practice, the value was chosen as about 25 pF, the minimum realisable in the test cell, and took the form of stray earth capacitance. With the arrangement, three series of measurements were made. The first was to establish the effect of a breakdown on an immediately subsequent test and the time taken for the effect to dissipate. It was found that one breakdown reduced the strength for the next test by about 15%, and recovery was slow, but could be accelerated to about 3 min by stirring.

The second series sought to establish the extent to which a voltage not producing a breakdown would improve the breakdown voltage of a test carried out immediately after. The third series was designed to enable the probability of breakdown to be determined as a function of voltage and spacing.

Pinhole Detection in Enamelled Wires

IN the coating of thin electric wires with enamel it is essential to be able to detect any pinholes in the covering as a manufacturing technique and the BS method prescribes a mercury bath through which the coated wire is passed. This can be considered as destructive, in that the mercury will contaminate bare copper wherever it is exposed. An alternative, non-destructive method described by K. W. ffitch and P. Graneau (BICC Ltd.) is based on the detection of corona at pinholes in a device in which the wire is passed through a tube with a high potential applied between the wire and the tube. The paper, "Non-destructive Pinhole Testing of Enamelled Wire by a Corona Method," gives the formula for determining corona onset conditions and details the method of counting pinholes.

Testing A.C. Line Compression Fittings

THERE are now several hundred thousand compression-type fittings on the CEGB overhead transmission system which totals over 10,000 miles. The rate of failure has been less than one/1,000 miles/annum, but it is known that there are a number of suspect fittings in service. Most operational faults are due to poor workmanship during erection, since manufacturing faults are usually found at an early stage.

V. T. Morgan and D. W. Vaughan (CERL) presented a paper, "Testing of Compression Fittings on Steel-cored Aluminium Conductors for Overhead Lines," in which they describe the tests carried out both on dead and live lines.

Dimensional checks before and after compressing are found to be necessary and resistance measurements usually disclose faults of incorrect compression, dirty contact surfaces, misalignment of the aluminium sleeves and poor contact at bolted surfaces. Maximum resistance is taken as 75% of an equivalent length of conductor and the test is made by a heavy current direct-reading instrument or by simple volt drop. Separate leads are used for current and test connections, the former being spaced at least 40 diameters of the cable apart. Contact must be made to all outer strands.

Radiographic examination is excellent for detecting misalignment of the aluminium sleeve, insufficient internal contact length, blowholes and cracks or unwanted inclusions. Magnetic locating devices are used for checking the position of the steel sleeve in the fitting. Ultrasonic methods have not been found suitable for detecting flaws for various reasons, and visual examination is usually sufficient for ensuring that grease has been applied to the external surfaces, though no method has yet been devised to see that it is properly dispersed within the joint.

The paper describes methods of testing on live lines which are limited by the hazards of testing at e.h.t. voltages, particularly in the British climate. The paper concludes with a recommendation for four-year surveys on all overhead lines.

Radioactive Gas Detects Leaks

THE paper by P. F. Berry and J. F. Cameron (UKAEA) on "The Detection of Leaks in Sealed Electrical Components with a Radioactive Gas" describes methods which are used on such small electronic components as transistors. The most suitable gas is ^{85}Kr in a container pressurised to 50 lb/sq in. After a suitable period the gas is returned to the container, the components removed and tested for leaks with a scintillation counter. In an alternative method, components are filled with a few microcuries of gas before sealing and the gas which leaks from it in a vacuum chamber is collected and passed to a counter.

Water Content in S.R.B.P. Insulation

INSULATION resistance has long been used as a non-destructive test for detecting the presence of water in insulation, but the method has its limitations. Even when immersed in transformer oil as a component, the insulation can take up water and suffer a lowering in breakdown properties. A. W. Stannett's (CERL) paper on "The Detection of Incipient Breakdown of Oil-immersed Bakelised Paper Contaminated by Water," shows how, according to present-day studies, the presence of water in s.r.b.p. insulation may be detected by insulation resistance measurements.

The water content is greatest at the exposed surface, decreasing rapidly with distance from the surface, and low insulation resistance components usually fail in service through thermal instability of the outer skin. He shows how the critical surface conductivity at which breakdown will occur can be calculated and compares the estimated figures with actual breakdown figures in a number of cases. Some agree within reasonable limits.

A.C. leakage conductivity is the property required for assessment of insulation directly, but this cannot conveniently be measured as a routine check on site. The best that can be done is to measure d.c. insulation resistance, but this changes with test voltage in some cases.

He shows that extrapolations of the graphs of d.c. insulation resistance with test voltage, when plotted on log/log paper, can be used to estimate the insulation resistance at the working temperature and the a.c. resistance (and, conversely, conductivity) agrees fairly well with d.c. resistance when there is appreciable water contamination. The laboratory results, however, need confirmation on naturally-contaminated samples.

In the paper, "The Measurement of Water in Power Transformers," A. W. Stannett continues the subject by stating that water is the only contaminant of importance in transformer oil and that local thermal breakdown of the solid insulation is likely, if power factor is increased by water contamination. The measurement of water by determination of the insulation resistance of the winding is an unreliable method, as shown by an experiment which he describes. The preferred technique is to insert paper probes in the bulk oil of the transformer as close as possible to the solid winding insulation, the probes being provided with evaporated gold grid electrodes on each face. Calibrated before insertion for resistance against water content between 1½% to 8%, they give an accurate and instantaneous value of the water content whilst still *in situ*, subject only to a correction for temperature.

Fine Wire Inspection Techniques

THE winding and drawing of fine non-ferrous and ferrous wires, such as are used in the cable and electric heating industries, is accompanied by the constant problem of ensuring that there shall be no subsequent wire breakage from such faults as holes or splits in the wire, metal inclusions of a foreign nature, etc. A great deal of ingenuity has been applied to the monitoring of the wires during both drawing and winding processes and some of the techniques are described in J. A. Nawiesniak's (BICC) paper, "Electromagnetic Inspection of Non-ferrous Wires and Helically Wound Heater Elements."

The techniques are designed for high-speed production and inspection and are, of course, of a non-destructive type. Discrete faults, such as holes, splits and inclusions, are detected by comparison between differential coils operating in an a.c. field of suitable frequency. The system produces a transient voltage output containing components from every parameter defining the electrical and mechanical properties of the material being examined. The size of ferrous particles in non-ferrous wires may be less than 0·001 in. across and the coils to sense them are made with many turns of very fine wire. Care has to be taken to see that the coils are carefully balanced pairs but, even then, it is not always possible to distinguish between wire breakage and an inclusion.

Soft Magnetic Materials

TESTING of soft magnetic materials can be carried out satisfactorily on small specimens for the usual properties of permeability, losses at high and low flux densities and the three qualities which characterise the hysteresis loop; saturation flux density, remanence, coercivity.

The preferred methods use the specimen as the core of an inductor from whose electrical characteristics the magnetic properties of the core can be deduced. The most suitable form is a closed ring.

Small specimens require observations of inconveniently small potentials and currents. In their paper, "The Testing of Small Specimens of Soft Magnetic Materials," A. C. Lynch and G. W. Eastwood (Post Office Research Station) describe methods and apparatus which have been developed for these classes of test.

Measurements of inductance and loss are by bridge methods, modified Maxwell or Owen bridges being suitable up to 10 Mc/s. Saturation flux density, coercivity and remanence are usually measured by d.c. methods which are insensitive. An alternative is an a.c. method which switches the specimen repeatedly between saturation and some other state, deducing from the signal in the output winding the magnitude of the flux changes produced. Magnetising current is derived from two sources and applied to separate windings; one provides unidirectional pulses, the other, d.c. of opposing polarity and adjustable magnitude.

Solderless Wrapped Connections

BRITISH DEVELOPMENTS ON A U.S.A. DESIGN

THE solderless, wrapped type of connection is, as yet, comparatively unknown in the UK, though it has been widely used in the USA over the past ten years. The operation is carried out with the aid of a simple tool, either hand- or power-operated, and it is claimed that it is more reliable than an average soldered joint. The connection is formed by wrapping a conductor wire round a terminal with controlled tension.

In a paper, "Testing of Solderless Wrapped Connections," A. C. Delamere and R. T. Weeks (STC) describe work which has been done to evaluate the wrapped type of connection and the methods whereby the wrapping tools are maintained at a high state of efficiency in production.

Despite the fact that the wrapped termination is easy to make and is popular with operators, it has certain inherent disadvantages. As the outcome of development work in this country, an improved form, the bound-type solderless connection, has, it is claimed, greater flexibility of application, while a yet further development, the twin-tag bound joint, is particularly suited to connecting card-type assemblies.

Since interest is rising in these types of connection in the UK, particularly in electronic fields, the GPO and Ministry of Aviation (RRE) have issued specifications, while others are known to be in course of preparation.

Tests already carried out over a period of nearly a year have featured heat ageing, freezing, temperature cycling, etc. Both wrapped and bound joints have shown themselves to be reliable, but the need for careful handling of the joints, both during making and afterwards in service, is apparent. There is also a general tendency for the resistance of all types of wrapped and bound connections to increase with time, but the rate of increase is greater with wrapped joints. Measurements of resistance were made on strings of 200 joints and, immediately prior to failure, the change of resistance on the bound joints was less than 20mΩ, while that on the wrapped joints was approximately 50 mΩ, the increase in each case being uniformly distributed over the individual joints.

Vibration tests showed that, with beryllium copper wrapping wire, there was a decrease in d.c. resistance after initial conditioning at 175°C, and a study of the metallographic structure was made in an endeavour to determine the reason for this. The results were, however, not very illuminating. Severe climatic and environmental tests on a number of unusual experimental connections caused some components to fail or change in value, but none of the faults could be attributed to the connections.

These investigations have fully confirmed the confidence placed upon them in the USA and it is considered that tests on actual production equipment may be limited to visual inspection of the finished joints alone. As a check of tool maintenance, mechanical tests on sample joints from each wrapping tool and operator should be carried out once or twice daily, according to the rate of output of finished connections.

In a related paper, "The Significance of the Measurements Made in the Non-destructive Testing of Electrical Joints," J. P. B. Williamson (Tube Investment Research Labs) discusses the behaviour of permanent mechanical joints, such as the bolted, crimped and swaged connections for electrical lines and busbars, and examines the effects of temperature cycling, creep, and the oxidation on interfacial surfaces on the electrical conductivity of the joint.

He points out that joints often have to withstand surge loads and it would be very useful if a non-destructive test could be devised to assess their behaviour under such conditions. At present it is generally assumed that voltage drop is a relevant test, but this is only partially true; behaviour of a joint under surge conditions depends on properties to which voltage drop is not sensitive. In fact, no really satisfactory test is known. But that is not to say that a reliable method is beyond the realms of devising.

Cable Measurement During Extrusion

THE close control of insulation covering thickness during the production of plastics-insulated cables by extrusion methods involves some difficulties in that the hot insulation emerging from the die head is too soft for mechanical methods of checking and, when the covering has cooled, it is too late for rectification. A photo-electric method of controlling the thickness is described by A. C. Lynch and E. A. Speight (PO Research Station) in the paper "A Photo-electric Device for Measuring Cable Diameter During Extrusion."

The apparatus comprises a lamp, a horizontal slit which is narrow compared with the diameter of the cable, a lens group producing a parallel beam mounted in a rotating disc, masks with horizontal edges, one of which is adjustable, a condensing lens and a photo-electric cell. Rotation of the disc produces alternating light and dark periods in a sequence of five, the centre dark period being monitored as a proportion of the whole cycle time, this figure being a measure of the overall cable size.

The equipment, which has now been in service for thousands of hours in a factory, controls thickness within ±0·001 in., and is unaffected by up-and-down movements of the cable over ±¼ in.

Leaks in Gas-filled Cables

H. T. GOODING and T. A. Briant (BICC) present two papers in which aspects of gas leaks in buried pressurised cables are discussed. The first, "Location of Gas Leaks in Buried Pressure-cable Systems," describes the methods which are used with success for locating leaks in buried cables. Attempts to use the highly odorous gas, amyl mercaptan, in the nitrogen filling to enable the fault to be detected by smell are not very successful unless the site is first excavated. Other methods, such as the oxygen sandwich and direction-of-flow test, prove to be too tedious for general use. Two methods which are described as giving reasonably good results are the fall-of-pressure technique, involving the measurement of pressure at the extremities and intermediate points, and the halogen detector. A third, which may prove a useful alternative to the latter, is one using radioactive isotopes. The methods are described in some detail.

The second paper, "Location of Serving Defects in Buried Cables," describes techniques for locating weaknesses in the protective serving which is applied to all gas- and oil-filled cables for protection against corrosion. General practice is to check insulation resistance between the sheath and earth on each cable length after installation. Tests made with an insulation-resistance type of instrument do not always disclose cuts which are of the self-healing kind and the Board's Specification C.4 calls for a 10 kV, 1 min test between sheath and earth. Location of the fault can be by Hilborn loop test, which gives a rough position, with a subsidiary test to identify the actual position.

A more recent method is the "pool-of-potential," a technique requiring a portable d.c. test set, with a maximum output in the region of 12 kV and a cam mechanism to give a coded series of signals, and a receiver, a high input impedance battery-operated differential millivoltmeter. The two are paraded along the route of the line spaced about 12 ft apart by separate operators and, in the vicinity of the fault, the receiver responds to the coded signals. By determining the position of maximum signal strength, the position of the leak can be located with some accuracy. Faults may be located on cables laid direct or in earthenware conduit by the technique and may avoid the necessity for a terminal test.

DISCHARGE TESTS ON CABLES

THE breakdown of a cable dielectric is always preceded by a period of discharge which, if detected at an early enough stage, can be used as the basis of a non-destructive monitoring system in production without harming the cable. Local areas of weak dielectric strength can be cut out or, if the cable length has too many weak points, it can be scrapped without the expense of subsequent testing.

Three papers covered this interesting aspect of cable technology. J. D. Endacott and E. L. Smith (BICC), in their "Electrical Discharge Measurements at High A.C. Voltage on Extruded Insulation as a Routine Test During the Manufacture of Plastics Insulated Cable," deal principally with the problems of polyethylene-insulated power cables, in which the dielectric is particularly susceptible to discharge attack and cannot be operated at a competitive stress unless it is discharge-free. They describe the non-destructive inspection apparatus which has been developed on a method of determining individual discharge magnitudes due to Dr Mole.

This apparatus examines the core minutely at a rate comparable to that of the extrusion process and easily detects the maximum specified discharge intensity of 2 pC. Applied to production, it locates discharge sites to within 1 in. in cable lengths up to 5,000 yd and has reduced incidence of faults in finished cable to negligible proportions.

The cable, with the conductor earthed, is passed through a tubular assembly filled with de-ionised water, at the centre point of which is a high-voltage electrode. Earthed electrodes are positioned at each end, so ensuring a uniform potential gradient along the cable insulation inside the assembly. The h.v. electrode is connected to a discharge-free test transformer through a discharge-free blocking capacitor and the whole is contained by a screened enclosure.

Details of the detection equipment and calibration features are described and an alarm circuit, enabling the apparatus to be operated unattended by technical personnel, is also outlined. The techniques are also applicable to other forms of extruded plastics insulation.

F. H. Kreuger (Nederlandesche Kabelfabrieken) deals in his paper, "Scanning of Screened Plastics Cable," with the same technique as applied to metal-screened cables. Scanning of screened cores is possible because the screens are usually semi-conductive. The resistance between electrodes displaced along the screen is sufficiently high for the electrodes to be regarded as separate.

The screened cable is wound on a drum with a conductive barrel which is earthed. From this it passes over wheels, which act as test electrodes, to a second earthed drum and a high voltage is applied to the inner conductor. Discharges which occur in the zone between the wheels are measured on a bridge circuit, the sensitivity of which is limited by contact noise between wheels and cable. Discharges down to 1 pC to 2 pC can be detected at 20 kV, and continuous recording of the discharges is adopted.

R. C. Mildner (Dow Chemical Co.) described similar developments which had taken place abroad, and traced the development of the techniques over the past 30 years in his paper, "Continuous Discharge Testing of Extruded Cables."

Damping Vibration on Overhead Lines

IT is a long cry from the aeolian harp of ancient times, but the principles which applied to that somewhat mystic instrument have very real impact on overhead line design today. T. V. Morgan (CERL) points out that the conductors on the grid system are particularly prone to aeolian vibration generated by eddy vortices formed as the wind passes over the conductor and, unless steps are taken to counter the vibration, conductor failure through mechanical fatigue will result after a few years in service.

The paper, "The Detection and Damping of Overhead Line Vibration," deals first with the methods of detecting the vibration, including such devices as vibrating-mass recorders, electromagnetic transducers, piezo-electric strain gauges and accelerometers, etc.

Magnetic tape recording enables more data to be stored while telemetry methods can be used to transmit data obtained from transducers on energised lines to a recording van in the close vicinity. In the programme of experimental work undertaken by the CEGB, most of the measurements were taken by vibrating mass recorders.

A broad description of the field work on line vibration carried out by the CEGB since 1932 is then summarised and the results of such devices as the Stockbridge and Elgra dampers, polythene tubular dampers and comparative vibration on single- and twin-conductor spans is outlined. A guide to the method of damping long spans with devices of the Stockbridge type is given, which enables the number of dampers/span, the distribution along the span and the distance of the first from the suspension insulator clamp to be determined.

Conductor Dancing

T. R. WARREN and G. S. Wilton (SSEB) deal with the experiences on the Mill-Harker 275 kV line between Glasgow and Carlisle in their paper, "Conductor Dancing Control." This line, a double circuit construction on steel towers, each comprising three twin conductors in almost vertical formation, has had 28 faults through dancing since it was energised in 1954. With the help of meteorological forecasts, patrols have been sent out whenever conditions seemed to favour dancing and one instance of clashing has been observed.

Damage to the lines is difficult to locate, and even serious burns on the conductor are not always visible from ground level. Some have been located by the Ferranti electric pulse-echo system of fault location; others have needed close inspection from a bosun's chair slung on the line. Various steps have been taken to stiffen the lines where dancing has been experienced and the problem here is being brought under control. Further research into conductor oscillation is to be carried out in conjunction with the CERL.

Light Duty Contact Resistance

THE importance of resistance between the contacts on light duty switches, relays and similar components is brought to the fore in J. Pullen's (ERA) paper, "The Measurement of the Resistance of Light Duty Electrical Contacts." Chief causes of faulty operation is the formation of contaminating films between the contacting surfaces and the loss or transfer of material by arcing on making and breaking. Contacts carrying less than 1 A fail usually on account of the contaminating film; on heavier ratings, contact erosion is the more frequent cause and in both cases the effects are most significant on low-voltage circuits.

Actual measurement of contact resistance is subject to a number of difficulties. First of all, the terminal points of the resistance path must be precisely defined and separate current and voltage connections made to them. Since the resistance is to be expected of the order of a few milliohms, this is of vital importance. But there is no rigorous method of separating the contact resistance from that of the whole system and the difficulty is of practical importance when the area of the contact spot is comparable to that of the conductor.

For experimental purposes, a convenient form of test contact is that provided by crossed cylindrical wires. This arrangement lends itself particularly well to the four-terminal type of connection and the effective measuring points are near the middle of the permissible range. In practical switching devices, such as relays, the contacts may be inaccessible and it may be necessary to measure the resistance between the instrument terminals and make a correction for the internal connections.

The last and most important feature is the dependence of resistance on the test conditions and the precautions to be observed are described. Current carried by the contacts is not an influence as an independent variable but, if the contacts are closed and opened, the voltage must not be allowed to rise above the permitted level through inductance in the test circuit.

NOTES ON WIRING

BY MEGOHM

IN company with many other electrical engineers in the London area, I listened with great interest to Mr J. A. Robbins lecturing on miniature circuit-breakers. The opportunity of hearing an expert on m.c.b's was indeed welcome. I go as far as to say "necessary," for we all know that the argument "for and against" has been going on for some time now. I particularly liked the manner in which the lecturer told us the problems which the designers of m.c.b's had to overcome, how this was done and how the finished product could be used to the fullest advantage. This was, in my opinion, a most useful and instructive method of approach to the subject.

I understand that in certain department stores, m.c.b's have been used to replace the normal fuseboard and bank of switches underneath. This is an excellent arrangement, and on investigation I understand that the maintenance electrician in one store is convinced that it has cut down his work of rushing to various departments to see to lighting failures. The ordinary store assistant is capable of understanding that if the lights go out there is every chance that they can be restored by re-setting the switch on the m.c.b. A good point in circumstances where light failure could lead to accidents and theft.

Many of these large stores are now realising the value of lighting both to trading and to selling. Some of the value is lost if the lights fail and it takes an electrician 10 min to 15 min to get there and get the fuse repaired.

Many questions were asked by the audience after the lecture, and I understand that the general feeling was that the time is not too distant when m.c.b's will be in "common use." There are, naturally, many things to be taken into account when planning an installation *completely* protected by c.b's. It is welcome news that a British Standard for m.c.b's has reached the draft stage, and so should be available next year.

Zinc-plated Boxes

Another argument which has been going the rounds for some time concerns zinc-plated boxes. It is brought to my notice through tests carried out by a manufacturer. Some time ago the question was asked whether zinc-plated boxes were the ideal type to use with m.i.c.c. cables. Originally the idea met with approval, then it received adverse criticism, and now it would appear that it has come back into favour again. I, myself, have neither the time nor the facilities to carry out tests for my own satisfaction. I received some criticism for hanging two conduit boxes on my fence once, and I have never repeated such tests since. Anyhow, the manufacturer who has told me of tests on zinc boxes, reports that no corrosion or action between zinc and copper was evident after a six months' test. In fact, he feels that it might well become standard practice in this country to zinc plate all boxes instead of enamelling them.

This is rather a sweeping statement in view of the costly plant required to do this type of plating, but is, in fact, a *considered* statement. Zinc plating has, apparently, stood up to damp conditions extremely well and my friend now intends to test enamelled boxes under similar conditions.

Here again, I feel that these statements might well lead to arguments, but I merely *report* the facts as told to me —and I have no reason to doubt my informant. In fact, these tests were carried out by this manufacturer to "see for himself," and there is not, in my view, a better way of proving the point.

Speculative Buildings

Before 1939 the man who built houses "on spec" was known in every town. Today, there is little "speculation" about building houses. The demand far exceeds the supply, and perhaps that is the reason for new house-buyers being held to ransom where those necessary electric points are concerned. Only last week I was given details of the prices of "extra points" set out in a brochure describing a new house costing £5,000. One thing I must admit, the *basic* installation was rather better than those I have seen in the past, but one glaring error, that of only two 13 A sockets in the kitchen, pointed the way to the accumulation of "extras." Extras, in my opinion, which should not occur in houses of that cost range. It is difficult enough to find the basic cost of the house without having to pay out for extras. It should be appreciated that the costs were relevant only when the house was in the *carcase* stage. Once the plastering, etc., was done, then the cost was obviously increased. The cost of an additional 13 A socket was in the range of £3 10s to £3 15s. The wiring, I might add, was p.v.c.-sheathed type with "protection" on switchdrops and wooden bases at switch positions.

I cannot see a cure for this sort of thing and I know that engineers who have members of their family reaching the age when they are contemplating house purchase, must feel very worried about it all. And, of course, there are hundreds of young couples who do not even have an engineer in their midst to guide them. A most vexing problem indeed.

IEE Regulations

Most readers will now know that a booklet giving certain amendments to the thirteenth edition of the IEE Regulations has been published. At the same time, the news is given that preparation of a revised fourteenth edition of the electrical engineers' "Bible" has been approved by the Council of the IEE, and it is anticipated that this will be available sometime after the end of 1962. All users of the Regulations are asked to submit comments on the present edition.

I wonder how many engineers will comment? Is it too much to ask that the Regulations be worded in a more down-to-earth way? I feel that it should be borne in mind that the site operative uses these Regulations as much as anybody, and his interpretation often clashes with the professional engineers' interpretation. This, I know, is a delicate point, and being rather heavy-footed I may well offend, but I do sincerely think that these Regulations really need some plainer expressions used in them.

There are, of course, many new points to cover, and I would like to see some new ideas on "earthing" arrangements put into these Regulations. No doubt, after consideration, I could suggest a few more changes but I would like to hear my readers' views first.

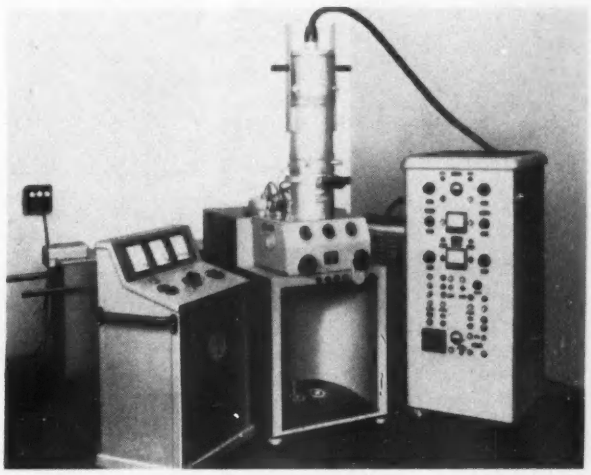
Electron Beam Welding and Machining

LABORATORY TECHNIQUES REACH PRODUCTION STAGE

THE use of the electron beam for welding, drilling and machining operations has long been established as a laboratory technique. The high energy density of the electron beam —which may be of the order of 500 MW/sq cm or more—makes it an ideal instrument for localised heating in very small areas but, of course, the operation has to take place in a vacuum. In the last few years the Carl Zeiss Foundation, of Oberkochen, West Germany, has been developing production machines which can be operated by relatively unskilled staff—that is, without any specialised electronic knowledge—and which are suitable for machining operations on specimens down to about $\frac{1}{4}$ mm at one end of the scale or up to 25 ft long at the other.

The three groups of machine are designed for specific operations of welding, drilling and machining but, of course, each machine can also be used for other operations within certain limits.

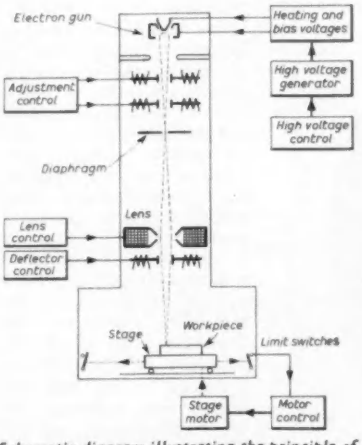
The Zeiss Model ES.1002 Electron Beam-welding Machine



Welding

Taking, first, the beam-welding machine, some 40 of these are now in productive use throughout the world, the majority of which are in the USA. Two companies in Britain, Rolls-Royce and Lucas Ltd., have also installed one and others are being contemplated. The price of an electron beam-welding machine, with all ancillaries, is about £16,000.

The main advantage of the electron beam in welding is, naturally, the highly localised area of heating, which enables the workpiece to remain cool excepting only in that part on which the beam is focused. An additional feature of considerable importance is the depth of penetration of the beam. In comparison with other forms of welding, a gas flame can be concentrated into a minimum area of $1{\cdot}6 \times 10^{-3}$ sq in. with a maximum heating density of 320 kW(H)/sq in.; with an electric arc the heating density is about double this figure concentrated into one-tenth of the area; but, taking the Model ES.1002 as an example, the electron beam gives a heating density no less than 5,000 times that of an electric arc and can be concentrated into one-ten thousandth of the area. That is to say, the beam power is $3{\cdot}2 \times 10^{6}$ kW(H)/sq in. concentrated into a minimum area of $1{\cdot}6 \times 10^{-8}$ sq in. Even the apparent disadvantage of having to weld in a vacuum has its merits, for it ensures that the weld is not vitiated by chemical traces from fluxes or surrounding gases.



Schematic diagram illustrating the principle of the Zeiss electron beam-welding machine

The Beam-welding Machine

The complete beam-welding machine comprises five basic units; the electrical optical column, seen on its stand in the centre of the picture, the welding unit behind and below the column, the control cabinet to the right with, behind, the electron gun supply and, finally, the high voltage supply equipment to the left.

A section through the electron gun and vacuum chamber is shown schematically at left. The beam, with a power of up to 2 kW at maximum voltage of 150 kV, is produced, adjusted and focused on to the welding gap. The workpiece is mounted on a carriage within the vacuum chamber, the latter being traversed, under remote control, at a selected speed, to bring any required area or path under the beam. Focusing of the beam is effected by the lens control to allow for different surface heights on the workpiece and also to regulate the degree of penetration, while fine adjustment of position on the workpiece is obtained through the deflector control. The motor traverse allows for straight joints up to $7\frac{1}{2}$ in. in length and a hand crank feed gives cross traverse adjustment over a total distance of $4\frac{1}{2}$ in.

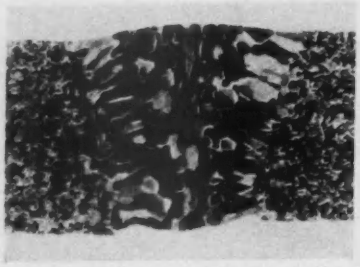
Larger machines are being developed with beam powers up to 4 kW and 12 in. working distances. In each case the welding progress is watched through a stereo-microscope with adjustable magnification.

Fields for Beam Welding

Electron beam welding permits high melting point metals like tungsten, molybdenum, tantalum and their alloys to be welded, not only without difficulty, but with a degree of fusion more complete than previously possible. The focusing control also enables the welds to be made in places inaccessible to other methods. By the concentration of the heating into the confined area immediately in and adjacent to the weld, the total energy used is a small fraction of that possible in any other way. The power of penetration of the beam makes preparation of the edges by such devices as vee-butts unnecessary and any surface layers of oxide or other contaminant are completely vaporised and removed in the vacuum chamber. The surfaces themselves are fused in their whole depth and the welds can be applied to the abutted ends of sections only a few thousandths of an inch thick.

Milling and Drilling

The electron gun for the drilling and milling machine differs little from that of the welding machine, but the arrangements for controlling the workpiece table are modified. The basic principle is to concentrate the beam of high-velocity electrons on to a small, shallow surface



A specimen weld in molybdenum strip 1 mm thick effected by electron beam welding

area of the workpiece where the material is vaporised and removed in the vacuum. This is done without increasing the temperature of the immediately adjacent metal so the edge of the cavity is quite sharply defined. Moreover, the mechanical and physical properties are undisturbed. For machining large areas, the beam is progressively deflected in much the same way as the electron beam in a television tube.

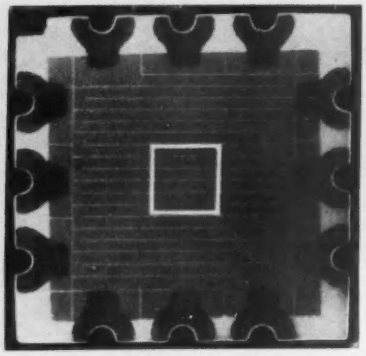
In order to avoid the penetration which is an essential part of the welding process, much higher power densities are desirable and these are attained without any significant increase in overall energy demand by applying the beam in a series of closely spaced, highly concentrated pulses. In fact, power densities up to 1,000 MW/cm are easily attainable which gives even closer tolerances in machining processes.

To drill a hole, beam penetration is not used, but the focused point of the beam is progressively advanced as the vaporised metal is removed from the surface in much the same way as a metal drill would be in a conventional drilling machine. The hole may be circular or of irregular pattern; it may be a slot or of any desired contour; it is just a matter of adjusting the controls and, of course, the beam can be adjusted to drill holes of any diameter and without the attendant risk of drill breakage, which is always a worry with fine drills.

The time required for milling a profile will, of course, depend on the material and the quantity to be removed. As an example, a slot 0·05 mm wide by 3 mm long in 0·5 mm thick sheet steel would take rather less than a minute, of which the first five seconds is used in actually removing the metal, and the balance in finishing off the hole to the required tolerances.

Ancillary Equipment

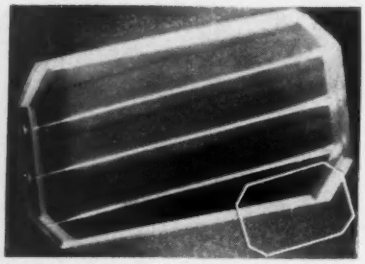
Apart from the electron gun and vacuum working chamber, a milling and drilling machine requires the following ancillaries. First, a vacuum pump for pre-evacuating the chamber and gun. This is a three-stage water-cooled oil-diffusion pump and the residual pressure is indicated on a meter on the control panel.



A micro-module resistance element of sputtered metal on an 8 mm square ceramic plate divided by a 10 micron line to form a labyrinth by beam machining

Secondly, a high-voltage generator to supply the accelerating voltage for the beam and which can be set to values up to 150 kV, according to the material and size of the workpiece. Thirdly, a pulse generator for intermittent operation of the beam, thereby localising the heat-affected zone. The control voltage of the gun is periodically varied by the pulse generator allowing the beam to be emitted only for small, regularly timed intervals. Both frequency and pulse duration are adjustable. Fourthly, a stabilised current source for controlling the focusing lens and electron beam and, finally, the beam deflection control panel which enables a choice of intensities, pulses and beam deflections to be chosen at will by the operator to suit the particular milling or drilling programme.

The price of the Zeiss electron-beam machine is in the region of £22,000 and about seven or eight are now in service, mainly in the USA. Among those currently using them are the Bell Telephone Laboratories, the three Westinghouse companies, Westinghouse Bettis Atomic Power Div., Westinghouse Cheswick and Westinghouse Headquarters Manufacturing Labs., Texas Instruments Incorporated and Dupont de Nemours. A machine is also being constructed for Philips of Eindhoven, and others are under consideration in this country, mainly in connection with the production of spinarets for artificial fibre manufacture.



A quartz specimen, 1·5 cm long through which a number of 1 mm holes have been drilled

Typical Applications

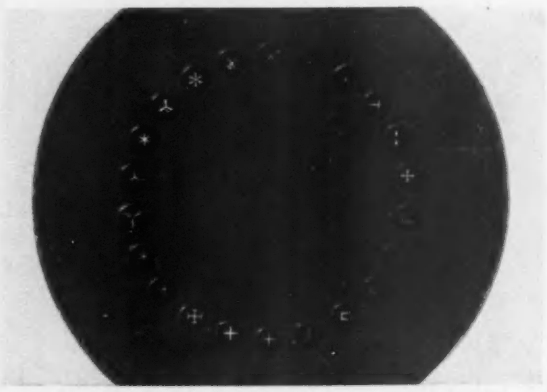
The four pictures on this page give some idea of the type of machining which can only be achieved satisfactorily by the electron beam as a tool. Top left is a specimen weld in molybdenum strip 1 mm thick. This was effected with a beam voltage of 130 kV and a current of 6 microamp. The rate of welding was 10 mm/sec and the microsection shows the uniform structure of the welded joint though the crystal size is, naturally, somewhat larger.

Top right is an enlarged photograph of a small quartz specimen through which a number of holes have been drilled. The actual size of the specimen is shown in white outline and the holes, 150 mm long, are 1 mm dia and were drilled at the rate of 3 sec each hole. This is evidence that electron beam processes are equally suited to metals and non-metals.

The picture at the top centre is a resistance element for a micro-miniature electronic assembly in which the resistance element is a sputtered metallic film which has been broken into a continuous labyrinth by removing a 10 micron wide line of film from the surface. The full size of the unit is shown in white outline in the centre. The same technique has been used to isolate the contact areas at the edge.

The final picture is of a 10 mm thick steel disc in which a number of counterbores have been made to leave a ½ mm thick bottom and through these a number of spinaret profiles have been drilled. The smallest slot is 36 microns wide and the specimen was made to show the versatility of design possible in fibre cross-section with electron beam drilling techniques. The reproduction is twice full size, since the holes would not otherwise be discernible.

Agents in the UK for these new machines are Messrs Degenhardt and Co. Ltd., of 6 Cavendish Sq, London W.1.



A specimen steel disc produced to show the versatility of profile possible in spinaret production by electron beam drilling. Magnification, ×2

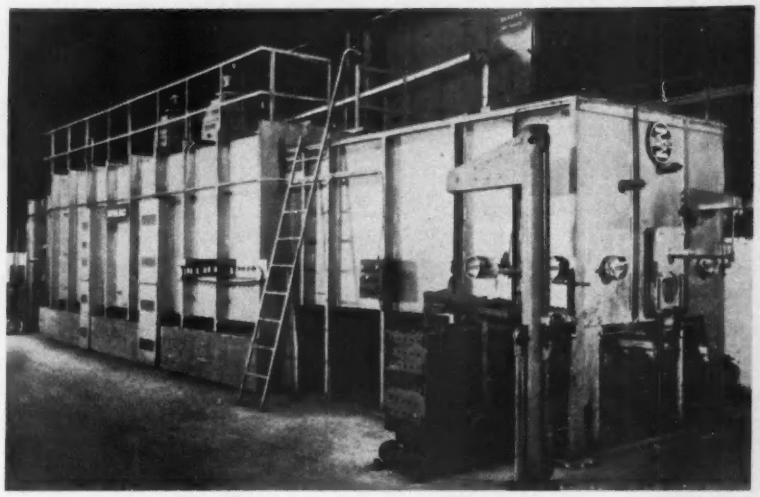
100-ton Continuous Electric Furnace

BIRLEC UNIT FOR ANNEALING WHITEHEART MALLEABLE IRON

A SIGNIFICANT proportion of the whiteheart malleable iron castings which have been produced in the UK over the past decade have been annealed by the Birlec gaseous process in elevator type batch furnaces developed by AEI-Birlec Ltd. A number of these furnaces have also been supplied for foundries abroad.

More recently, an alternative type, involving a continuous flow of castings through the furnace, has been developed to meet the demands of foundries with outputs in excess of 20-ton/week, and a 100-ton/month unit of this pattern was recently installed at Bullers Ltd., Tipton, Staffs.

This furnace is electrically heated and the elements, of nickel chromium tape, are located on pins in the side walls. These are divided into three zones for efficient control of temperature. The total loading is 250 kW and automatic control and recorders are incorporated.



General view of the 100-ton/month continuous annealing furnace from the delivery end

The Furnace

A general view of the furnace from the exit end is shown with, below, a schematic diagram of the unit as seen through the centre. The castings, on a tray, are loaded on to a trolley which is pushed from the side at the loading end on to an elevator. This raises it to hearth level where a hydraulic ram then pushes it into the furnace, automatically forcing preceding trays one stage farther through the heating and cooling zones. At the far, discharge, end a tray is simultaneously loaded on to a discharge trolley at hearth level, after which it is brought down to ground level by the unloading elevator.

This type of construction enables the entry and exit ends of the furnace to form a gas lock without doors and decarburising is ensured by the introduction of humidified air at a predetermined rate of flow into the heating area, the process being uniformly maintained by fan circulation within the area. The atmosphere composition is constantly monitored by a CO_2 recorder.

The trays are cast nickel chromium grids supported on shoes of similar metal resting on the rails running through the furnace, the grids being surmounted by the special containers.

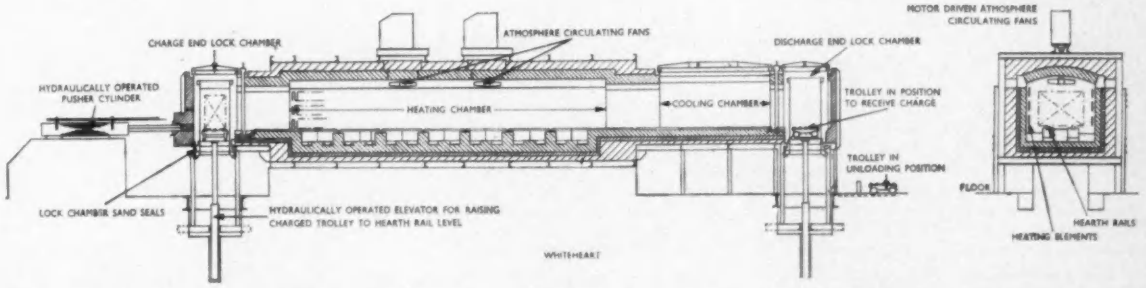
Operating Cycle

All movements are hand controlled and a timing device warns the operator when to introduce and unload the next charges. At present, a 76 hr cycle is being used; one tray being discharged every 4 hr. The normal capacity of the trays is 11 cwt of castings, but with some castings the full loads cannot be carried. This means that maximum output would not be achieved, but some adjustment may be made by reducing the cycle time or increasing the electrical loading according to the size and section of the castings.

It is, as yet, early to give actual operating costs, but it is known that they will be lower than other methods of annealing this type of casting.

The continuous elevator furnace does not, of course, outdate the batch elevator furnace, of which three Birlec types, rated at 300 kW, have been in continuous use for a number of years at Messrs Bullers works. A considerable part of the throughput comprises castings which do not need to be spheroidised and the continuous type of furnace is ideal for this work. Spheroidising, the conversion of the graphitic content to the spheroidal or nodular form, calls for a controlled rate of cooling. Castings which have been annealed in a continuous or batch type furnace can be reheated for a spheroidising cool either in a separate furnace associated with the continuous elevator unit or in a batch elevator furnace specially allocated to the process.

The continuous furnace at Tipton is the first of its kind and, after several months' operation, has already established its value in increasing output. Other units, for installation abroad and with outputs 50% to 100% greater, are under construction.



Diagrammatic sectional views of the continuous electric furnace installed at Bullers Ltd., Tipton, Staffs, showing how the "gas locks" are effected

Maintaining Ignitron-controlled Welders

NOTES ON PREVENTIVE TECHNIQUES

by B. Court

IGNITRONS are best classified as gas discharge pool-type-cathode valves, and are used either for power rectification or, in the case of welding equipments, for the purpose of controlling the primary current which is supplied to the welding transformer. Various types of welding equipments use the ignitron for control, because such valves are designed to carry the very high currents necessary in resistance welding.

However, basically, ignitrons consist of a water-cooled stainless steel envelope, a cathode, an anode and an ignitor. The latter electrode is used to strike the arc at the surface of the cathode, which in this valve is a pool of mercury. When the arc is transferred between the cathode and anode, it will remain ignited without any further assistance from the ignitor.

Cooling

Preventive maintenance is essential for all ignitron-controlled welding equipments, and first and foremost should come the checking of the water feeds and supply, so as to ensure that there is adequate water flow equal to that specified by the manufacturer.

The flow should not in any way be impeded, otherwise excessive valve temperature will result, and cause internal arcing, which in turn may result in the envelope becoming punctured. It is advisable to allow the water flow to continue for a specified period after the equipment is shut down, so that the value can be cooled to more or less room temperature.

Exceeding the maximum ratings will also result in overheating of the valve. Periodic checks are advisable to avoid this.

Open Circuits

Ignitrons used in welder practice are usually connected in inverse-parallel; that is to say, two valves are used arranged so that each valve will conduct an opposite half cycle and produce an a.c. output. Should one of these valves fail through non-conduction, then the remaining ignitron can easily be destroyed, especially if long welds are attempted. Failure of one of the ignitrons can also be the result of the welder being operated with an open-circuited secondary. Such a condition arises from lack of periodic maintenance on the welder electrodes, incorrect electrode pressure, or corroded contact points in the secondary circuit. This trouble can also be due to the contacts of the relay in the ignitor circuit being broken or even chattering.

Should it be found that one of the ignitrons develops a cracked seal, resulting in the valve going down to air, then the water flow to the valve may be found to be insufficient.

The installation of a replacement ignitron must be carried out with a certain amount of care. Steps should be taken to ensure that the valve is in a true vertical position, otherwise the ignitor will be incorrectly immersed in the mercury pool. This will cause erratic operation and shorten the life of the ignitron.

Before replacing what one may think is a faulty ignitron, it is advisable to check the rectifier and thyratron in the ignitor control circuit. Should any of these feeder valves be at fault, then half-cycling may result.

Cleanliness of ignitrons and contacts is of the utmost importance. Failure to secure this will produce high resistance connections due to corrosion, which in turn produce excessive heat at the terminations.

Gassy Conditions

Gassy ignitrons will cause erratic spitting at the welder electrodes, although this fault seems to clear itself after the equipment has been in operation for a short time. Nevertheless, a gassy ignitron can be identified by disconnecting the ignitor lead and noting if the valve glows when switched on. Should a glow be present with this lead disconnected, then the valve is failing, and will have to be replaced. On the other hand, the ignitron may not be gassy, in which case a check should be made on the welding transformer, as erratic operation can be traced to moisture penetrating the transformer windings.

Occasional cold welds and fluctuation of weld heat suggest that the ignitron is nearing the end of its life. These faults, however, can also be due to the thyratrons in the circuit failing. A visual indication will be recognisable in the thyratrons; that is, the glow is different in colour or it becomes intermittent in operation.

In conclusion, it is advisable for those engineers engaged on maintenance of such equipments to bear in mind that safety precautions must be taken when servicing, as high voltages are present.

COMPUTER CONTROLS REFINERY

EXTREME of automation is closed-loop computer control for a full production process. Since September, this has been applied at the Tulsa, USA, refinery of DX Sunray Oil Co. The firm responsible are Thompson Ramo Wooldridge Inc., whose computer systems are marketed, installed and serviced in the UK by International Systems Control Ltd., a joint venture of the firm and GEC Ltd. Last week Dr D. N. Truscott, managing director of ISC, announced in London that information on operating techniques at Tulsa would be made available to British refineries and those in Commonwealth and EFTA countries through ISC.

The 85,000 barrel/day refinery, which replaces five older units, is claimed to be the first major refinery unit to incorporate a computer control system in its original design.

Computer Facilities

The RW-300 computer installed provides continuous and automatic control by scanning 191 process instruments and adjusting 30 controller setpoints to maintain optimum efficiency. Such variables as temperatures, pressures, flow rates and general chemical conditions are checked at 10 min intervals, and their values compared with predetermined limits which are stored in the computer memory. Using this instrument data, and a mathematical model of the refinery process, the RW-300 exercises direct control over the distillation unit by adjusting automatically the appropriate controller setpoints.

Incorporated as peripheral equipment with the computer are an analogue input equipment and three automatic logging typewriters, which provide a printed log of all process variables every other hour on demand. The overall control console provides facilities for the operator to impose manual control if he feels it necessary.

The chemical process carried out at the refinery is a three-stage distillation.

Cost Savings

An official of the operating company has said that the RW-300 computer will provide them with operational efficiency far greater than could be hoped for by use of conventional methods alone. Savings in operational costs and maintenance are expected to be substantial. Despite this, the installation is to some extent experimental. It is hoped to gain knowledge from the installation which can show the way to computer control for the company's other manufacturing units.

Reliability

So far, there are 30 TRW computer systems in use in various industries, and ten more are on order. Over 300,000 operational hours have been logged, and it is claimed that average reliability exceeds 99%.

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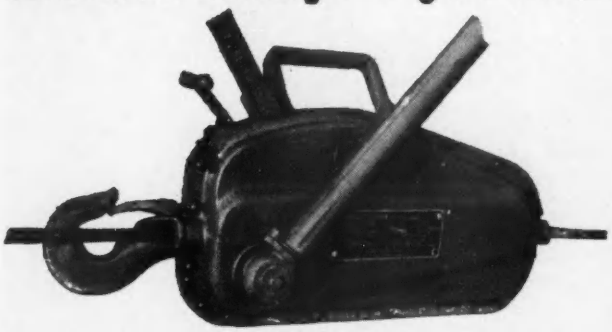

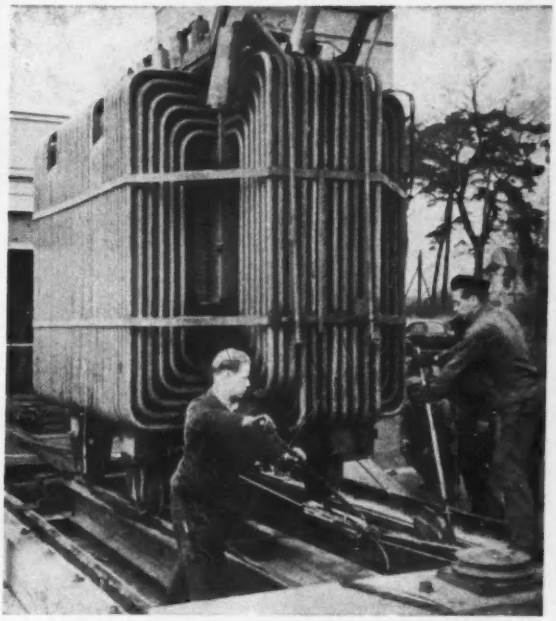

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Checking Contact Fire Safety

OF all the possible fire hazards associated with the use of electricity, the most serious is possibly that caused by defective electrical contact when a condition develops which has been called "red sparking." This is the opinion of ICI's C. M. Thornton, expressed in a paper to last week's IEE conference on non-destructive testing. He goes on to discuss ways in which it may be possible to check the danger-potential of particular items of plant in this respect.

Red Sparking

Red sparking is an entirely different condition from power arcing, which produces a blue spark, and when taking place between copper and brass electrodes at currents over 5 A, it has a contact-voltage drop of about 3 V. Red sparking cannot occur between clean surfaces, but if a clean contact carrying current loses all its contact pressure and is subject to slight vibration, momentary power arcing will occur, which in time will cause sufficient oxidation of the contact surfaces to permit red sparking to start. The power arc itself is unstable and only lasts a few cycles and, therefore, has only a limited heating effect, although it has a great incendiary effect on gases.

Red sparking comprises a very short arc at the point of contact, which moves about over the contact area, accompanied by glowing of the oxide layer conducting current in the same area, and spattering of incandescent particles. The process is self-sustaining as more oxide is continually formed, until ultimately a bright-red molten bead of oxide bridges the contact and conducts the current indefinitely. At any time during the course of red sparking the contact may either open circuit or "frit" (the expression used by a prominent worker in this field, R. Holm). In either case, the contact temperature falls rapidly to a comparatively low value, but it cannot be relied on that either of these two changes will occur, or that red sparking will not start again spontaneously.

High Temperatures

No protective device normally employed will operate when red sparking starts and, moreover, metal contact parts supported by insulation can attain, at the point of contact, temperatures far higher than those at which most insulating materials will ignite, and these temperatures can be maintained indefinitely.

Although high temperatures are attained at the contact point, the temperature gradient in the metal is also generally high, so it is necessary only to keep the point of support by the insulation at a sufficient distance from the point of defective contact to reduce considerably the temperature that the insulation has to withstand. In short, it is generally possible to make equipment safe in this respect by design, even when using materials which will not withstand the temperatures attained at the contact point.

Test for Danger

It follows that a test of the danger of initiating a fire should comprise a type test on the complete equipment, a non-destructive test in so far as the preparation of the equipment for the test is concerned; a test in which the insulation is not mutilated in any way for the purpose of the test. Some damage is inevitable in the course of the test, and the amount of it is a necessary criterion of failure. An essential feature of such a test is a standardised means of simulating the heating of the defective contact.

The arc drop at the contact being fairly definite, it follows that the release of heat is also definite and nearly linearly proportional to the current. The first proposal, therefore, was that point sources of heat should be introduced in turn at each point at which red sparking might develop, releasing the same amount of heat. The equipment would pass the test if the gases given off by the insulation or the insulation itself did not ignite, or the insulation did not weaken dangerously. This test did not take account of the igniting effect of the red spark, and difficulties were experienced with the point sources of heat tried.

An attempt was, therefore, made to use the red spark itself as its own method of test. It was found that red sparking could generally be started in under 10 min between clean copper and brass contacts in air by manipulation. When, however, the same thing was attempted in an equipment, it was found that fumes from the heated insulation might inhibit the red spark and make it either difficult or impossible to start in some cases.

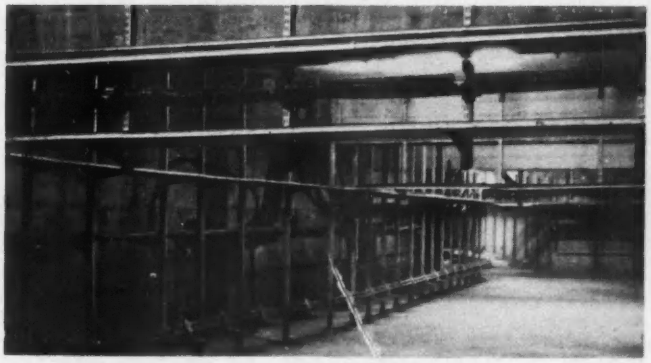
Various devices have been tried to enable the red spark to start immediately, and the temperature to rise rapidly to its final value. The most promising device found so far is to coat the copper electrode thinly with ferrous sulphide, which can easily be formed on it by heating, in a bunsen flame, a mixture of iron and sulphur powder adhering to the previously moistened electrode. This enables the red spark to start immediately and to continue with less attention than that required by a bare electrode, but unfortunately the temperature hesitates between 3 min and 6 min in the region of 200°C before rising to its final value. This might enable gases to escape ignition which would be ignited in service by the red spark between bare electrodes. Once such a red spark is started, it may raise the contact temperature steadily and rapidly without any hesitation.

Future Work

In the course of many tests, no reason has been found to suspect that equipment which would be ignited by red sparking with bare contacts would fail to be ignited by red sparking with one contact coated with ferrous sulphide, but many more tests are required to confirm this.

Steelworks Cable Racking

EXTENSIVE cabling for a 10 MVA arc furnace and other components of a continuous casting plant at Barrow Steelworks is run on spur cable racking supplied by Savage and Parsons Ltd., of Watford, Herts. The racking system consists of slotted steel channels into which cantilever brackets can be fitted at any desired height, at 1½ in. intervals. Single channels are bolted to walls and steelwork, or two channels may be bolted together to form rigid box-section members. A simple bolting system on the brackets fixes standard cable trays, or holds a spur top plate for fixing single or double tiered cable cleats, trefoil clamps and supports for uncleated cables. Provision is made for duplication.



Spur cable racking installed in the substation basement at Barrow Steelworks

Electric Patenting Furnace for Wire Ropes

NEW EFCO UNIT IS RATED AT 700 kW

THE term "patenting" may be unfamiliar to the average engineer or layman in relation to wire-rope manufacture, but to those in the industry it implies a process whereby the microstructure is improved between drawings by heating the wire rods to a temperature just above transformation point and then quenching in a lead or salt bath.

At the Doncaster works of British Ropes Ltd., a new continuous patenting furnace has recently been put into service which is electrically heated and has been designed and manufactured by Efco Furnaces Ltd., of Weybridge, Surrey, in conjunction with the engineering staff of the user company.

The furnace chamber is 6 ft 6 in. wide, with a heated length of 90 ft, and is heated by hairpin-shaped, nickel-chromium elements, roof mounted, with a total loading of 700 kW. The terminal connections are arranged along one side of the furnace and individual sections can be removed for maintenance or replacement without disturbing any of the remainder.

The elements are divided into six separately controlled zones, each with its own step-down transformer, temperature controller and recorder. The transformers are designed for adjustment to give fine control and these, together with switchgear and controllers, are housed in an enclosure, 40 ft by 11 ft, mounted centrally over the centre of the furnace, and with access by a stairway at one side.

Careful attention has been given in the design to the electrical loading in the individual zones and to the heat distribution necessary for uniform temperature across the width of the furnace.

Special precautions have been taken to avoid damage to the heating elements being caused by the passage of hooked ends between one set of rods and the following, the rods, of which 32 can be accommodated, being positioned by guide blocks at both ends. Normally the rods lie flat while in transit but, at the loading ends, metal guards are provided over the heating elements to prevent the hooked ends catching up.

On emergence from the furnace, the heated rods are passed into a molten lead bath for quenching before moving to the next drawing stage. The installation at Doncaster is one of a number supplied to British Ropes by the company, and a similar furnace for lighter gauge wire is in course of erection at Doncaster.

Roller Coating Machines for Core Plates

THOUGH the name of C. A. Parsons and Co. is best known in relation to the steam turbine and turbo-generator, the company is also among the leading British manufacturers of transformers. During 1960, close on 1,350 MW of generating plant in all was commissioned. of which rather more than 50% went overseas. Today, 550 MW units are under construction together with about 750 MVA of transformers, many of which are designed to operate at 330 kV.

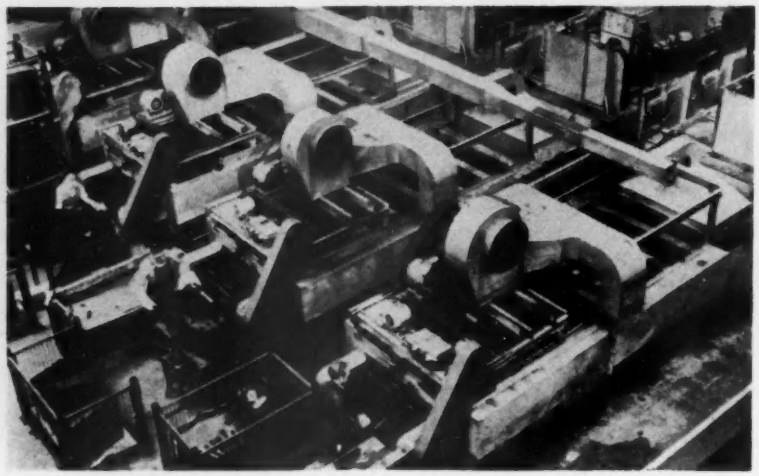
An essential requirement for both transformers and generators is steel plate for the laminated magnetic cores, stators and rotors and, with such a programme, the total tonnage which passes through the works in a single year is considerable. The plate is received in sheet form and has to be stamped and punched, after which the sections are coated on both sides with core-plate insulating varnish.

It is now more than 30 years since Parsons first commenced applying the varnish by passing between coating rollers, but the machines which have been designed to cope with present-day throughputs are vastly different from the first. Four of the latest type have been installed, of which two usually manage to cope with planned programmes, the remaining two being held at standby to deal with sudden demands, breakdowns or other emergencies.

Each machine will handle laminations of all shapes and sizes, up to 5 ft wide and of any length, which are hand fed into the rollers where they are coated with Pinchin Johnson's black oil-proof core-plate varnish before passing to gas-heated chambers. Here the solvent is flashed off at 100°C. The sheets are next conveyed to the electrically heated drying chamber, maintained at 360°C, after which they are gradually cooled and stacked in collapsible steel pallets. After inspection, they are passed to the assembly shops for incorporation in the transformers or generators.

The coating machines were made by Controlled Heat and Air Ltd. and the control of the drying oven is effected by Honeywell Brown automatic equipment which also stops the machine should there be any serious variation in gas or electrical heating supplies. The core-plate varnish is stored in large cylindrical tanks outside the 700 ft long, 100 ft wide shop housing the stamping and punching mills and roller-coating equipment.

Incidentally, the present-day works at Heaton, on the site originally chosen in 1889 when the company was founded, covers an area of 61 acres and employs close on 8,000 technical and works staff.



General view of the feed end on the core-plate roller coating machines at the works of C. A. Parsons Ltd., Heaton-on-Tyne

E.I.B.A. Ball, 1961

Once again the EIBA Ball attracted a distinguished gathering to Grosvenor House last Friday. Nearly 1,000 guests were received by the President, Mr R. A. Marryat, and Mrs Marryat, and after the dinner Mr Marryat read a telegram from the Association's patron, H.M. the Queen, in reply to a message of loyal greetings. Highspot of the evening was a raffle for more than 40 prizes presented by the industry and drawn by Mrs Marryat. There was also an entertainment. The Association benefits from this year's Ball by nearly £2,000. Accompanying the President were the immediate past President, Mr. R. R. B. Brown and Mrs Brown, and Sir Robertson King and Lady King.

1, The President, Mr R. A. Marryat and Mrs Marryat; 2, Mr and Mrs Mortimer Hawkins being presented; 3, Sir Charles Cunningham, Mr J. I. Bernard and Mr C. T. Melling and ladies; 4, Mr S. F. Steward and daughter; 5, Mr W. A. Gallon, Mr and Mrs F. H. Dickinson; 6, Mr R. E. Landsbert, Mr and Mrs T. C. Landsbert and Mr L. J. Gooch; 7, Mr and Mrs Ernest Peckham, Mr and Mrs A. C. Horsman; 8, Mr and Mrs D. J. Sells; 9, Mr and Mrs A. E. Nicol, Mr and Mrs C. W. Taylor; 10, Mr and Mrs T. Cook, Mr and Mrs E. W. Semmens; 11, Mr and Mrs J. Ratter, Dr and Mrs Beeching; 12, Mr and Mrs J. H. Curo; 13, Mr and Mrs D. E. Bird, Mr and Mrs N. L. Keen; 14, Mr H. Spencer, Mr S. B. Warder, Sir Robertson King; 15, Mr Hindley, Mrs A. N. Irens and Mr W. J. Bird; 16, Mr A. S. Shier, Mr and Mrs W. Medcalfe

Personalities *in the industry*

Mr A. H. Campbell

Mr E. J. Blythe

Mr J. H. Stevens

Mr J. A. Enwright

Mr G. L. Ball

Deputy chief financial officer to the CEGB since early 1958, **Mr A. H. Campbell,** C.A., has been promoted to chief financial officer of the Board. He succeeds **Mr J. M. Drummond,** F.S.A.A., F.I.M.T.A., whose appointment as financial adviser to the Electricity Council we recently reported (*ESH, page 50). Mr. Campbell joined the Central Electricity Board in 1932 as an assistant accountant, later becoming chief assistant to the district accountant for the north east and mid-east England area. Early in 1946, he left the CEB to become senior assistant to the chief accountant of the groups of companies controlled by the Yorkshire Electric Power Co. and Electrical Distribution of Yorkshire Ltd. In March, 1948, he became divisional accountant of the Merseyside and North Wales Division of the BEA, and, in March, 1954, divisional accountant of the newly formed North West, Merseyside and North Wales Division, the position he held till 1958.

Mr E. Taylor and **Mr C. Fitton** have been elected directors of Hailwood and Ackroyd Ltd. **Mr S. E. Willett,** who retires by rotation, will not seek re-election at the forthcoming annual meeting.

Mr G. T. Kent, B.SC., A.M.I.E.E., has recently been appointed a director of Herga Electric Ltd.

Formerly first assistant district engineer (M and O) at Melksham, **Mr H. Gaskell,** B.SC.(ENG.), A.M.I.E.E., has been appointed district engineer at Yeovil to the Southern Electricity Board.

Mr F. Ryecroft, A.C.I.S., has been appointed chief clerk of the South Wales Electricity Board's Swansea district. He succeeds **Mr G. Thomas,** who recently retired after 37 years' service in the industry. Since February, 1957, Mr Ryecroft has been senior clerk of the Severn Vale district of the Midlands Electricity Board and, earlier, held various appointments with the North Western Electricity Board.

Sales manager of the Wolseley Engineering Co. Ltd. since 1949, **Mr F. D. Swift** has been appointed to the board as sales director. **Mr G. R. Hands,** formerly export manager, also becomes marketing director.

Mr E. J. Blythe, B.SC.(TECH.), A.M.I.E.E., has joined Aircraft-Marine Products (Gt. Britain) Ltd. as chief product manager, and will operate from the London headquarters. Following his graduate apprenticeship with English Electric Co., Mr Blythe has held posts in research and development with Ferranti Ltd., Standard Telephones and Cables Ltd. and the MO Valve Co. For the past ten years he has been concerned with the development and production of transmitting valves.

Another new A-MP appointment connected with the company's research and development programme is that of **Mr A. Fowke,** D.F.H., GRAD.I.E.E., GRAD. I.MECH.E., who is now in charge of the A-MP laboratories. Mr Fowke was educated at Exeter School and Faraday House Engineering College, London. His postgraduate training was with the National Coal Board and Metropolitan-Vickers Electrical Co. and he was subsequently, for 18 months, with John Brown (Special Engineering and Nuclear Developments) Ltd.

Changes in the board of the Rheostatic Co. Ltd. are announced. The chairman, **Mr M. J. Gartside,** because of greatly increased responsibilities within the Elliott-Automation Group as a whole, is, while remaining chairman, relinquishing the position of managing director of the Rheostatic Co. Ltd. He is being succeeded in that position by **Mr J. H. Stevens,** who has for many years been a director and the general manager of the company. It is also announced that **Mr H. C. E. Miller,** who has been associated with the Rheostatic Co. Ltd. since its foundation 40 years ago, has retired for health reasons, and **Mr E. O. Herzfield,** director of Elliott-Automation, and **Mr G. C. Fairbanks, Snr.,** director of Elliott Brothers (London) Ltd., have joined the board.

Mr C. R. Garnett, B.SC.(ENG.), A.M.I.MECH.E., A.M.I.E.E., has been chosen to be the first station superintendent at Sizewell nuclear power station of the CEGB. He is at present operation services engineer of the Nuclear Operations Branch at CEGB headquarters.

Mr W. T. Marchment, for 15 years divisional manager of the Instrumentation and Controls Division of Evershed and Vignoles Ltd., has been elected to the board of the company.

Mr J. A. Enwright has been appointed a director of the Wayne Kerr Engineering Co. Ltd. and **Mr G. L. Ball,** B.ENG., A.M.I.E.E., becomes sales director of Wayne Kerr Laboratories Ltd. Mr Enwright joined Wayne Kerr as sales and contracts manager in 1953 and was appointed general manager in 1955. Before joining the company he was with the Ministry of Aircraft Production and the Ministry of Supply, during which time he was closely concerned with the development of electronic components and equipment for military purposes. He was a member of many Service committees and was particularly concerned with REMC. In addition to his special responsibilities for Government contract liaison, Mr Enwright now co-ordinates all engineering services for the Wayne Kerr companies. Mr Ball is a Canadian

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**Denotes revision to the "Electricity Supply Handbook, 1961."*

who first came to this country with the Royal Canadian Signals during the war. In 1945 he returned home to study at McGill University, where he graduated in engineering before returning to England to take up a post as a development engineer with Standard Telephones and Cables Ltd. In 1952 he joined the Telegraph Condenser Co. as a technical sales engineer, after which he was sales manager of the Plessey Swindon Components group for three years before becoming Wayne Kerr's general sales manager in 1958.

Five new appointments have been made by the Yorkshire Electricity Board. **Mr H. Pickup,** B.SC.(TECH.), M.I.E.E., at present sub-area engineer, No. 5 (Wakefield) sub-area, is to be manager of No. 2 sub-area. **Mr W. E. B. Nettleton,** M.I.E.E., who is now manager of No. 5 sub-area, moves to No. 3 sub-area in a similar capacity. **Mr J. S. Yates,** M.I.E.E., A.M.B.I.M., at present deputy chief engineer to the Board, is to succeed Mr Nettleton as manager of No. 5 sub-area. **Mr G. L. Tomlinson,** A.M.I.E.E., now sub-area commercial officer, No. 3 sub-area, is being promoted to manager of the No. 7 sub-area in place of the late Mr D. R. Williams, and **Mr E. Cockroft,** A.M.I.E.E., at present sub-area engineer, No. 7 sub-area, moves to a similar position at the No. 5 sub-area (*ESH, ages 141-147). Mr Pickup has been the Board's No. 5 sub-area engineer since 1952, having previously served with the South West Scotland Electricity Board as construction engineer and planning and development engineer, Glasgow sub-area. His earlier experience was gained with the Lancashire Electric Power Co., which he originally joined in 1932. Mr Nettleton, who has been manager of No. 5 sub-area for the past five years, was earlier engineer for No. 3 sub-area for seven years. Prior to vesting day he had been with the Sheffield Corporation undertaking, ultimately as deputy distribution engineer. Mr Yates only became the Board's deputy chief engineer earlier this year after five years as engineer for No. 2 sub-area, and eight years as system planning and design engineer, No. 2 sub-area. Mr Tomlinson has held the position of commercial officer to No. 3 sub-area since 1948, prior to which he was sales development engineer to Sheffield Corporation for two years. His earlier experience was gained with the St. Helens and Blackburn Corporations' undertakings. Mr Cockroft has been with the Board's No. 7 sub-area since 1948, being sub-area engineer there from 1957. Earlier he served at Barnsley, West Bromwich and Halifax.

Second assistant engineer (planning and development) in the Norfolk sub-area Engineering Department, **Mr R. D. Parker** has been appointed district engineer at Gt Yarmouth to the Eastern Electricity Board. He succeeds **Mr J. E. Walker,** A.M.I.E.E., who is now manager of the Colchester district (*ESH, page 109). Mr Parker received his early training in the electrical industry with Johnson and Phillips Ltd. and joined the Norwich Corporation Electricity Department in 1934 as a mains engineer, transferring later to development work. When the industry was nationalised he joined the Norfolk sub-area.

Eastern Electricity Board have appointed **Mr D. Fulcher,** F.C.C.S., secretarial officer at the Fens sub-area, to succeed **Mr E. E. Cooper,** secretarial officer, Essex sub-area, who is retiring at the end of this year (*ESH, pages 107, 108). Born and educated in Norwich, Mr Fulcher has held a number of appointments with local authorities. When the electricity supply industry was nationalised he joined the Fens sub-area as assistant secretarial officer, becoming secretarial officer in 1950. In 1956 he attended a management course at Horsley Towers and he also studied management practice at Wadham College, Oxford. He is a member of the apprentice training board of the Eastern Electricity Benevolent Society management committee and alternate member of the district joint council.

Previously divisional executive member (Rugby) and chief engineer of the Transformer Engineering Department, Rugby, of the AEI Transformer Division, **Mr K. W. McBain,** M.I.MECH.E., M.I.E.E., MEM.A.I.E.E., has been appointed chief engineer of the Micanite and Insulators Co. Ltd., an AEI subsidiary. Mr McBain joined the Transformer Engineering Dept. at Rugby in 1924 after gaining technical and practical experience in many branches of engineering. After many years in charge of the Large High Voltage Transformer, Rectifier Transformer and Miniature Transformer Sections of the department, he was appointed manager of the BTH Transformer Engineering Dept. in August, 1950. At Rugby, he has been responsible for the design of some of the largest transformers built in the world and has been associated with many new transformer constructions. He is well known to many engineers in different parts of the world and has visited Canada, USA and most continental countries. For some years he has been a member of the Batti-Wallahs' Society. Mr McBain has served on technical committees concerned with transformers both in Britain and at international levels. He has always been interested in the welfare and training of young engineers and from 1926 to 1939 was on the part-time staff at Rugby College of Engineering Technology as a lecturer in higher mathematics and advanced engineering subjects.

Mr J. P. Hannah, D.S.O., P.J.K., who retired from the position of general manager of the Perak River Hydro-Electric Power Co. in Malaya last year, has now joined the board of the company.

Important changes in its internal administration are announced by British Welding Research Association. These are intended to extend the scope of services for industry and to enable fundamental work, particularly in arc physics, to develop unfettered. The former Welding Process and Resistance Welding Sections have been merged in a Welding Technology Department with wide terms of reference. It will have extended facilities for investigating all new methods of welding and welding technology. Administration of this department is the responsibility of **Mr P. T. Houldcroft,** B.SC., F.I.M., formerly the Association's chief metallurgist, who now becomes

Mr W. E. B. Nettleton

Mr R. D. Parker

P. T. Houldcroft

Mr K. W. McBain

Mr D. Fulcher

head of the department, with **Mr A. A. Smith,** B.SC., A.I.M., formerly in charge of the Welding Process Section, as deputy head. Complete administrative responsibility for, and control of, the metallurgical laboratory is assumed by **Mr H. F. Tremlett,** B.SC., A.R.S.M., F.I.M., the deputy director of research, with **Dr R. G. Baker,** M.A., PH.D., and **Mr J. G. Young,** B.SC., as chief metallurgists in charge, respectively, of ferrous and non-ferrous researches. **Dr A. A. Wells,** B.SC.(ENG.), PH.D., A.M.I.MECH.E., the assistant director of research, who also controls the Association's engineering researches, will also control work in the physics of the electric arc, including the development of electronic control and monitoring systems. The integration of the resistance and arc welding processes will bring into line such fringe processes as friction and electron beam welding.

Mr J. E. Dallas has resigned from the board of Lloyds Packing Warehouses (Holdings) Ltd. and its subsidiary and associated companies, which include Long and Crawford Ltd., Argosy Radiovision Ltd. and Regentone Radio and Television Ltd.

Mr D. J. Venning has been made sales director of New Electronic Products Ltd., an associate company of Honeywell Controls Ltd. He will be responsible for sales of medical, industrial and scientific electronic equipment for NEP, in the UK and abroad. He will also formulate market requirements. Mr Venning has been micro switch sales manager at Honeywell since 1955, a post he assumed after some years in engineering and manufacture at the Scottish factory. He joined Honeywell in 1947. **Mr J. L. Lunn** replaces him as UK micro switch sales manager, having specialised in micro switch sales with the company since 1956. He will be responsible for formulating market requirements.

Edgar Allen and Co. Ltd. announce that **Brig Levesley,** O.B.E., M.C., T.D., M.I.MECH.E., has been appointed president of the Welded Tool Manufacturers' Export Association and of the Welded Tool Manufacturers' Association in succession to **Mr R. P. Wallace,** of Jessop-Saville Ltd. **Mr B. H. Chambers,** manager of the Engineers' Tool Department of Edgar Allen and Co. Ltd., is a member of the committees of these Associations, but he will be succeeded by **Mr V. W. Oakes** at the end of this year on his retirement from the company.

Three new senior appointments in their Control Gear Division at Kidsgrove, Stoke-on-Trent, have been made by the English Electric Co. Ltd. **Mr F. E. Waspe,** A.M.I.E.E., becomes chief development engineer; **Mr G. H. Gunnell,** A.M.I.E.E., is promoted to chief control engineer, and **Mr E. J. Pepper,** A.M.I.E.E., is now chief design engineer. These appointments are intended to streamline the Division's research and development programme for multi-motor control centres, variable-speed drives, static switching and control gear for machine tool drives and industry in general. Mr Waspe is responsible with his design team for multi-motor control centres. He joined the company as switchgear contracts engineer at Stafford works in 1948 and has also served there as applications engineer in the Metal Industries Division and as industrial control engineer at the company's Bradford works. He received his technical education at Handsworth Technical College and the Birmingham Technical College, and served as an apprentice with GEC, Birmingham. Subsequently he was employed by Birlec Ltd. as a project engineer. Mr Gunnell is responsible for all the control engineering for the company's multi-motor centres and also for the application of all forms of variable-speed drives, static switching and control gear for machine-tool drives and for the iron and steel industry. He joined the company as an apprentice in 1940 and was employed by the Special Engineering Section, Stafford, from 1954-56 before transferring to Kidsgrove. He has done work on magnetic slip couplings, power station auxiliary drives and test plant, including the RAE, Farnborough, high-speed wind-tunnel. Mr Gunnell was educated at Huntingdon Grammar School and Stafford County and Technical College. Mr Pepper is responsible for the component circuitry for industrial drives and control equipment where static equipment, such as magnetic amplifiers and semiconductors is employed. He joined the company in 1945 as an engineer apprentice and after serving as a laboratory engineer in the Industrial Electronics Division at Stafford moved to Kidsgrove in 1955 to become design engineer and subsequently section engineer in the magnetic amplifier field. During the course of this work he was responsible for the development and design of magnetic amplifiers for industrial controls, particularly in steel mill application. Mr Pepper was educated at Archbishop Holgate's Grammar School, York, and Beverley Grammar School and subsequently at the Hull Municipal Technical College and the Stafford College of Technology.

At present district administrative officer of the West Bourne district of the London Electricity Board, **Mr L. R. Billingham,** F.S.S., is to take over a similar post at the Board's West End district as from 1 Jan. next (*ESH, pages 79, 80).

It is announced by Glover and Main Ltd. that **Mr J. E. Benham** and **Mr C. S. K. Benham** have left the service and the board of its subsidiary, Benham and Sons Ltd., as a consequence of disagreement on matters of policy with the parent company. The new chairman of the subsidiary is **Mr E. L. Pixton.** Glover and Main Ltd. acquired the catering equipment business of Benham and Sons Ltd. about a year ago.

To co-ordinate the marketing arrangements of a number of companies within the group, Metal Industries Ltd. are establishing 14 regional offices in the UK. The new offices will each house the area sales engineers of Brookhirst Igranic, Lancashire Dynamo and Crypto, Lancashire Dynamo Electronic Products, Lancashire Dynamo Nevelin, Foster Transformers and, in some offices, J. G. Statter. The following appointments as regional managers (showing region and location) have been made: **Mr W. H. Soper** (Midlands, at Birmingham); **Mr W. Jones** (Mid-Southern, at Bournemouth); **Mr W. J. Weston** (South Western, at Bristol); **Mr F. R. Williams** (South Wales, at Cardiff); **Mr W. J. A. Gemmell** (Scotland, at Glasgow); **Mr B. L. Perkins** (Eastern, at Ipswich); **Mr H. R. Renfree** (N.E. Yorkshire, at Leeds); **Mr E. G. Harrison** (Central London); **Mr R. W. Puttock** (S.E. London, at Cheam); **Mr B. G. Scott** (N.W. London, at Wembley); **Mr A. S. Brain** (North Western and North Wales, at Manchester); **Mr F. D. Gough** (Northern, at Newcastle); **Mr F. W. Whiting** (N.E. Midlands, at Nottingham); and **Mr S. T. Wood** (S.W. Yorkshire, at Sheffield). In addition, four industry specialists on an MI group basis have been appointed. They are: **Mr J. R. Morgan** (steel industry specialist for the south, located at Cardiff); **Mr W. A. Worton** (steel industry specialist for the north, at Sheffield); **Mr F. Nye** (marine specialist for the south, in London); and **Mr K. B. Allan** (marine specialist for the north, at Glasgow). The appointments of three group consultants are also announced: **Mr H. J. Drummond** (attached to Manchester office); **Mr F. B. Rose** (attached to Newcastle office); and **Mr W. M. Hendry** (attached to Ipswich, Nottingham and N.W. London offices).

Mr A. D. Mackay, financial director of Standard Telephones and Cables Ltd., and **Mr J. F. Hitchcock,** general manager of STC's Private Communication Equipment Division, have joined the board of that concern's newly acquired subsidiaries, Phoenix Internal Telephone Systems Ltd. and the Private Telephone and Electric Co. Ltd. Mr Mackay is the chairman.

Kerry's (Great Britain) Ltd. announce the following appointments: **Mr I. Orme,** formerly of Oxford depot, is now depot manager at Cambridge; **Mr G. T. Ward,** of Chester depot, is now depot manager at Chester; **Mr R. E. Shippey,** formerly depot manager at Chester is now depot manager at Leicester; and **Mr A. T. Francis,** formerly depot manager at

Cambridge, has been appointed depot manager at Sheffield.

Mr L. G. Lewzey, M.C., T.D., F.C.I.S., F.I.E.S., has been appointed secretary of AEI Lamp and Lighting Co. Ltd. Mr Lewzey studied electrical and illuminating engineering at Northampton Polytechnic, and joined the export section of Metrovick Supplies Ltd. in 1928. Two years later he moved to the Lamp Department head office of Metropolitan-Vickers Electrical Co. and was later responsible for industrial lighting application and design. After war service he returned to that concern in 1945 and was appointed assistant to the sales manager of the Lamp and Lighting Department, and six years later became commercial manager. In 1956 he moved to the BTH secretary's department and two years later was appointed assistant secretary and assistant Comptroller of AEI Lamp and Lighting Co. In addition to that post he has been secretary of British Sealed Beams Ltd. since 1959. Mr Lewzey is a post council member of ELFA and EDLAC and last June was elected a Fellow of the Chartered Institute of Secretaries.

Mr D. H. Horton has been appointed works manager to the EMB Co. Ltd., of West Bromwich.

Executive director of Foster Electrical Supplies Ltd. since 1955, **Mr L. D. Gunnell** is to retire at the end of the year after 40 years' service. He is to continue his association with the company as consultant. He started with the concern in 1921 as a sales representative and two years later opened the Birmingham branch. From 1932 to 1955 he was sales manager.

OBITUARY

Mr E. P. Grimsdick, a former director of AEI-Hotpoint Ltd. and Ferguson Pailin Ltd., and chairman of International Refrigerator Co., died on 27 Oct. He had been with the AEI group of companies for 59 years, and for 48 years played an important part in the industrial development of India. From 1945 to 1954 he was also assistant to the managing directors of AEI. In 1954 he joined AEI Overseas and on retirement a year later was retained in a consultative capacity. He took part in the original discussions and negotiations with the Government of India in 1948 which resulted in the formation of Heavy Electricals (India) Ltd.

Mr J. Harrower, managing director of Phoenix Telephone and Electric Co. Ltd. since February last, died on 11 Nov., aged 58. He joined the company in 1939 as secretary.

Mr R. D. MacMillan, managing director of Controlled Heat and Air Ltd., died on 8 Nov., aged 57.

NEW LITERATURE

High Voltage Distribution Practice

ed. J. H. Gridley, B.SC.(ENG.), PH.D., A.M.I.E.E.

IN keeping with its title, this book puts the emphasis on practical problems of distribution engineering. It is a collection of articles by specialists who gave lectures in a symposium organised by The Polytechnic, Regent St, and has the great advantage as a reference book of being reasonably up to date. This more than compensates for the inevitable variation in treatment of the various subjects covered, which are, in order: general planning of systems, mechanical design of o.h. lines, erection of o.h. lines, substation design, system protection, lightning protection of lines, and operation and maintenance of equipment. From this list, it is apparent that there is little on underground cable work, or on transformers or switchgear as such. Within its range, however, this should prove a volume to be valued by area board engineers. Published by Ernest Benn Ltd., 240 pages, 9 in. by 6 in. Price 45s.

Static Fields in Electricity and Magnetism

by D. H. Trevena, B.SC., PH.D.

THIS is one more example of a textbook which is based on the notes for lectures given by the author when Lecturer in Physics at the University College of Wales. He makes no claim to originality and, indeed, there is little to distinguish the work from others of a similar nature which have appeared in recent times. It is inevitable that notes prepared for lecturing purposes should suffer, when presented *en masse* away from the platform, from a certain lack of comprehensibility, since it is the voice of the lecturer which provides the medium of making the dry assembly of mathematical formulae, symbols and quite unrealistic examples ("a soap bubble is charged to a potential of 3,000 V—") comprehensible to the student. This book has more than a sufficiency of formulae, more than 400 equations bearing individual references, apart from the attendant mathematical workings. The student might be excused if he nods. That is not to question the quality of the contents or the presentation. Is it not a little unfair, though, to make reference to the van der Graaff generator without a mention of its illustrious forebear, the Wimshurst machine? Published by Butterworths, 247 pages, 8½ in. by 5¼ in. Price 35s.

Nuclear Power Today and Tomorrow

by K. Jay

POPULAR interest in nuclear power generation is not always so well informed technically as it might be. Dependence is all too often placed in newspaper articles or the all-too-brief booklets on the subject by well-meaning writers with little experience of their subject other than what they, too, have read. The author of this book is an exception. A member of the scientific staff of the UKAEA's research group, he is well acquainted with his subject from the ground up, but he has not lost the art of writing clearly, succinctly and with a remarkable absence of "jargon." He leads the reader through an early examination of the modern concepts of matter and the principles which lead to fission and fusion chain reactions. He describes the basis of control of the reactions in a nuclear furnace and then outlines the development of the different forms of reactor which have been devised both in Britain and abroad. The style is clear and it holds the reader's attention from start to finish. There are also a number of interesting photographs. Published by Methuen, 263 pages, 8½ in. by 5¼ in. Price 25s.

BOOKS RECEIVED

Proceedings of the British Railways Electrification Conference, London, 1960. Comprehensive reference work on 50 c/s single-phase a.c. system including reports on discussions and summaries of papers in French, German and Spanish. Published by British Transport Commission, obtainable from Publicity Officer, 222 Marylebone Rd, N.W.1. 496 pages, 9½ in. by 8 in. Price £5.

Relais Electromagnetiques, by P. Chougnet. Details of construction and operation of electromagnetic relays. Published by Editions Eyrolles, 61 Boulevard Saint Germain, Paris Ve, 260 pages, 9½ in. by 6 in. 46 NF.

Mesures Electriques et Electroniques, by J. Thurin. Study of measurement techniques and equipment. Published by Les Editions Eyrolles, 431 pages, 9½ in. by 6 in. Price 54·55 NF.

Radio Today, by D. K. McCleery. Equipment and techniques surveyed for general reader with some scientific knowledge. Published by Oxford University Press in their Pageant of Progress series, 222 pages, 8¼ in. by 5¼ in. Price 21s.

Imperial College Calendar, 1961-62. Details of staff and courses at Imperial College, London University. Published by the College, 396 pages, 8½ in. by 5¼ in. Price 5s.

Portable Fire Extinguishing Appliances. Covers choice, installation and maintenance of portable fire extinguishing equipment. Published by the Fire Protection Association, 32 pages, 8¼ in. by 5¼ in. Price 2s.

Design and Installation of Electrically Warmed Floors, by L. Shepherd. Notes by Eastern E.B. Heating Engineer. Published by John D. Troup, 32 pages, 11 in. by 8¼ in. Price 6s.

A Power Policy for Britain, by K. L. Stretch. Former works manager of Calder Hall suggests a pattern of development. Published by Ernest Benn Ltd., 128 pages, 8½ in. by 5¼ in. Price 18s 6d.

Armatures and Field Coils, by K. Wilkinson. Collection and extension of articles on small machines previously published in ELECTRICAL TIMES. Published by E. and F. N. Spon Ltd., 224 pages, 8½ in. by 5¼ in. Price 35s.

Thermionic Valves Circuits, by E. Williams. Textbook for electrical engineering undergraduate students. Published by Pitman, 427 pages, 8¼ in. by 5¼ in. Fourth edition, price 27s 6d.

Two-speed induction motors

POLE-AMPLITUDE MODULATION FOR 840 H.P.

OVER the years, much ingenuity has been expended on obtaining two speeds from essentially single-speed induction motors. Something can be done by changing the number of poles on the stator by reconnection of the windings but, in spite of this, most multi-speed induction motors have been built with at least two separate windings. Only for the 2:1 speed ratio have pole-changing windings been at all extensively used. This situation has been radically changed in recent years by the work of Professor Rawcliffe and his colleagues at Bristol University on what he has called "pole-amplitude modulation."

Development

The idea of pole-amplitude modulation has been developed by some large electrical firms in association with the National Research and Development Corporation, and an important step forward was taken recently when CEGB engineers and representatives of consulting firms attended a demonstration of large two-speed, single-winding squirrel-cage induction motors at the Trafford Park works of Lancashire Dynamo and Crypto.

Some of the essential theory of pole-amplitude modulation is noted elsewhere in this article, but it may be said at once that in the system, pole-changing is accomplished as in the case of the familiar 2:1 tapped winding, by reversal of one part of the two-layer lattice winding with respect to another. In a 2:1 tapped winding, alternate pole groups are reversed to give pole-changing. With pole-amplitude modulation, selected halves of the phase windings are reversed with special grouping of the coils, and in some cases omission of certain coils to improve the m.m.f. pattern.

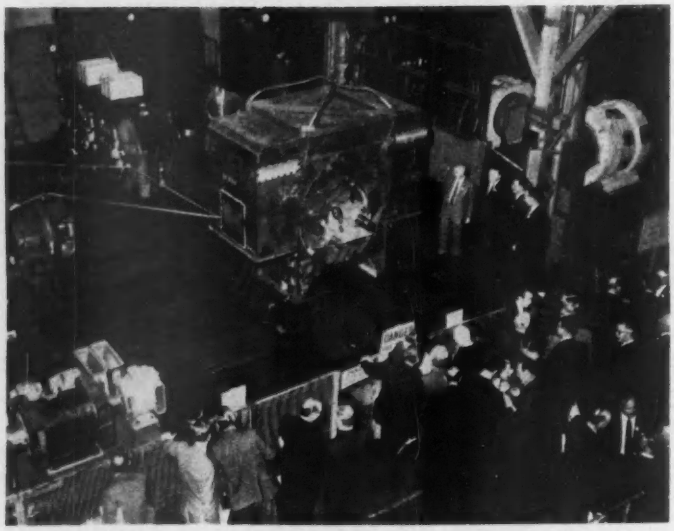
In one scheme which may be considered representative of pole-amplitude modulation practice, the motor stator winding is connected in parallel-star for high-speed operation; and series star (with some coils omitted) for low-speed operation. An alternative scheme has the winding connected parallel-star for high-speed and series delta for low-speed operations. In both cases the controller can be similar to a conventional 2:1 tapped winding starter; i.e., one 3-pole contactor and one 5-pole contactor or the equivalent. The choice between the alternative connections and between various coil groupings is made on a basis of matching the motor and load speed-torque characteristics.

Design Advantages

The principal advantage offered by the new motor designs are reduction in size and cost because of the better utilisation of winding space made compared with motors having two separate stator windings. Increased robustness is also claimed and better high-speed performance. In addition, the single winding is better adapted to mechanical supporting techniques than double winding, and also it has an increased heat capacity, an important factor in high-inertia loads.

Before the new windings were offered commercially, an extensive programme of prototype tests had to be carried out. In addition to the question of pole ratios, matters such as coil pitch, coil groupings, and slotting ratios are important factors for determining performance. In the development tests, windings which have been designed from theoretical considerations and which had been tried on small machines, were applied to machines in the 30 h.p. to 100 h.p. range.

In addition to normal tests at both speeds, the noise level, about which doubts had been expressed, was measured on loaded and unloaded machines and was found to be quite acceptable. Dynamic - speed - torque characteristics were taken on a Dudell oscilloscope, and the results showed that there was no objectionable torque dips at either speed. The results also led to the satisfactory conclusion that good agreement between design calculations and test results could be obtained.



A two-speed single-winding s.c. induction motor being demonstrated to CEGB engineers and consultants. Professor Rawcliffe, the inventor, is third from the left in the group by the motor

Applications

Pole-amplitude modulation is particularly suited where two speeds are required that are close to one another. Such applications occur in centrifugal fans and power drives where the load varies as the cube of the speed. They are also occasionally made with any constant torque drives, conveyors for

example. Connections of both types of load have been fully developed for 6/8- and 8/10-pole motors, and for multiples of these pole numbers. At present the top output limit has been fixed at 4,000 h.p. at the higher speed.

Typical examples of some LDC pole-amplitude motors in use or under construction are:

Vertical pipe ventilated 17/7·5 b.h.p. 16/20-pole motors at 400 V, 40 c/s, three-phase, driving cooling tower fans at 286/228 r.p.m. In this case the speed change is accomplished twice annually to suit climatic conditions by changing links in the terminal box. A normal, single-speed squirrel-cage starter is used.

Totally enclosed, "Corcooled" 336/148 b.h.p. 6/8-pole motors at 3·3 kV, 50 c/s, three-phase, driving ID fans having a WR^2 of 17,500 lb-ft². The starting current is limited to 4·5 times full-load current at both speeds.

Ventilated, weather protected 840/450 b.h.p. 8/10-pole motors at 6 kV, 50 c/s, three-phase supply, driving ID fans having a WR^2 of 100,000 lb-ft².

Switching

Switchgear for the demonstration of the motors mentioned above was loaned by Whipp and Bourne. In general, motor speed can be changed by altering links in the motor terminal box or by an off-load changeover switch, so that a conventional single-speed starter can be used for starting and stopping. Where automatic or remote control is required, a 3-pole and 5-pole contactor or an equivalent arrangement is needed.

As on all two-speed motors where the number of poles differ by two, there must be a time delay to ensure that the first field has died down before the motor is switched on to the second speed. If this precaution were not taken, the motor could be damaged by a large transient unbalanced magnetic pull.

Pole-amplitude Modulation Principles

THE essentials of pole modulation are described in Professor Rawcliffe's first paper (see below). In Fig. 1, (a) represents the distribution of m.m.f. from one phase of a three-phase winding, ideal sine half-waves being shown as rectangles for simplicity.

The distribution of m.m.f. can be expressed as a field strength $B=A \sin \frac{1}{2}p\theta$, where A is the amplitude and p is the number of poles, eight in the present case.

Suppose that A, instead of remaining constant, is modulated in space by making it take the form $C \sin k\theta$, as shown in (b). The combined effect of the field may be shown to be

$$B=\tfrac{1}{2}C[\cos(\tfrac{1}{2}p-k)\theta-\cos(\tfrac{1}{2}p+k)\theta]$$

This equation indicates, in general, a double field of two pole numbers (p−2k) and (p+2k), superimposed, one pole number being greater than the original and one less. In the particular case considered, there is a mixture of a 6-pole field and a 10-pole field.

The effective modulation can be obtained in practice by two methods of connection. The second half of the winding can be reversed as a whole with respect to the first part; or a section may be omitted from each half,

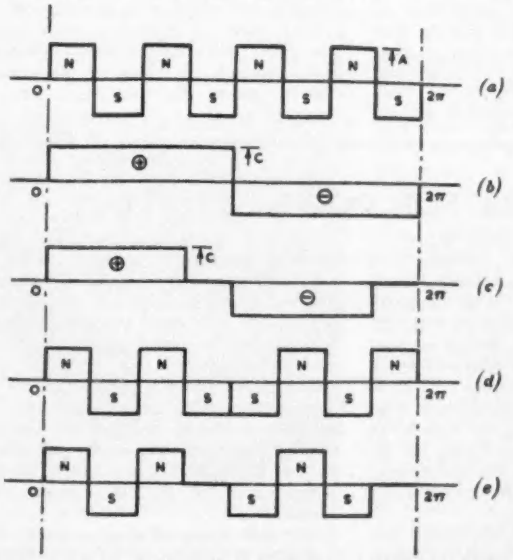


Fig. 1. Principle of pole-amplitude modulation, eight poles modulated to 6/10 poles

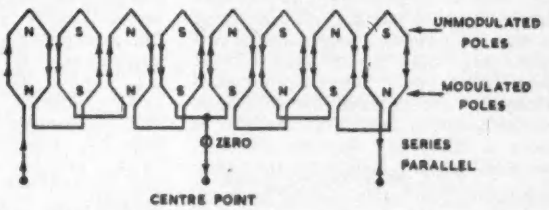


Fig. 2. Pole-amplitude modulation by series-parallel switching. (a) Layout and connections of coil groups for one phase unmodulated in series, modulated in parallel

and half the remaining portion reversed with respect to the other half. These two alterations of connection, seen in Fig. 1 (d) and (e), respectively, are equivalent to multiplication of the original wave by one of the forms Fig. 1 (b) or (c).

A space-modulated wave of two pole numbers mixed would have little value. However, it turns out that when the single-phase field of two pole numbers mixed is combined with the corresponding fields from the other two phases of a three-phase winding, and certain spacing relationships are met, then one pole number vanishes, giving a three-phase field of one of the pole numbers only.

What this may mean in terms of switching windings is shown in Figs. 2 and 3 for series-parallel connections, with modulation obtained by reversal of complete half-windings (i.e., (b) and (d) of Fig. 1).

In practice, refinements of these basic ideas are used. The diagrams here are taken from the IEE paper by Rawcliffe, Burbidge and Fong published in August, 1958 (Proceedings, Pt A). More recent ideas are set out in the paper by Rawcliffe and Fong published in December last.

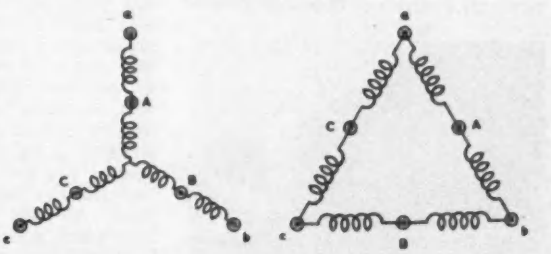


Fig. 3. Pole-amplitude modulation by reversal of complete half-windings. L, parallel-star/series star; R, parallel-star/series delta. First connection, supply ABC, join abc. Second connection, supply abc, join ABC

new products and appliances

Ceramic-cased tunnel diodes

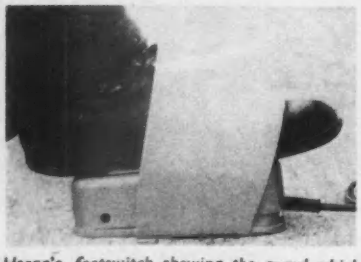
THE development of a technique of miniature ceramic encapsulation by Standard Telephones has enabled the operating frequency of tunnel diodes to be raised. The small size of these new devices—5·6 mm less tabs—and their tab-ended configuration have reduced their inductance to an extent that a typical limiting frequency of oscillation of 900 Mc/s is now attainable. A single version, JK30A, is now in production and will be followed by a new version incorporating a matched pair of tunnel diodes and forming a single integral unit with three tabs. These units will be matched for peak current and capacitance and are intended for application in the computer field. They can also be used in high-speed counting and logic circuits. *Standard Telephones and Cables Ltd., Connaught Hse, Aldwych, W.C.2.*

M-R cut Astral price

A PRICE reduction of 4 gn comes into immediate effect on the M-R "Astral" table model refrigerator. This 2 cu ft model now sells at 31 gn including purchase tax. A special set of legs to convert this model to a free-standing unit is available at 29s 6d. The production of the table model has now been transferred to the new M-R Gordie works at Dundee. Additional economies and streamlined manufacturing techniques are attributed to the reduction in price of this model. *Morphy-Richards (Astral) Ltd., Conduit St, W.1.*

Guards for footswitches

TO prevent inadvertent operation of footswitches on machines, which could become dangerous if operated accidentally, Herga have introduced guards for the switches in their range. To operate the switch the foot must first be inserted under the guard and chances of accidental operation are thus reduced to a minimum. Various contact arrangements are available in these new models, which cater for loads up to 15 A or 3 h.p. They can be either single, double or triple pole, and switches with two or more circuits closing in sequence can be provided. *Herga Electric Ltd., Wallingford Rd, Uxbridge, Middx.*



Herga's footswitch showing the guard which prevents accidental operation

Whisk is battery operated

A BATTERY operated whisk for mixing eggs and drinks is among the latest products in Pifco's new catalogue. It is powered by a standard U11 cell and has a chrome-plated body with push-button control at finger-tip position. The mixing rod is of steel and can be detached from the main body for washing. Cost is 10s 8d including tax and battery. Also in the catalogue is an illuminated magnifier which has a magnification value of seven. It is powered by twin cells and uses a 2·5 V lamp. A slide-operated switch is mounted on the chrome-plated body. Price: 11s 10d. *Pifco Ltd., Watling St, Manchester.*

Printed-circuit connectors

UNIQUE, staked-in types of printed-circuit connectors are now available in the UK as a result of an agreement recently reached between the Elco Corporation of Philadelphia and Magnetic Devices Ltd. The use of these connectors enables high contact pressures to be achieved without damage to the foil and permits the use of gold plating on the contact faces. The contacts are supplied in disposable plastics strips, each being positioned for immediate attachment to the board with a simple staking tool supplied by the company. Contact resistance is of the order of 3 milliohm and they are rated at 7 A to 10 A. They are used extensively in guided weapon and space research vehicles in the USA. *Magnetic Devices Ltd., Newmarket, Suffolk.*

Unusual terminal blocks

TERMINALS to withstand temperatures of up to 300°C have been announced by Austin Taylor. Individual assemblies consist of a porcelain block with silicone glass fabric separators, which can be mounted on a steel channel in any required number. Studs are 2 BA tinned brass and fitted with links, nuts and washers. Phosphor-bronze or stainless steel studs are also available.

Also recently introduced is a six-way moulded block of considerable interest to wiring contractors. With barriers between ways, it is suitable for fitting in circular conduit boxes and is intended for use on 15 A circuits. Supplied with connecting links and 4 BA clamp screws, the unit measures 2¼ in. diameter by ½ in. deep with 1¼ in. diameter centres. *Austin Taylor Electrical Ltd., Failsworth, Manchester.*

Illuminated magnifier

TO those requiring visual accuracy during intricate assembly operations, the new 1001 magnifying lamp is of particular interest. Consisting of a 4 in. dia lens illuminated by two 15 W bulbs and mounted on two extensible arms, the lamp may be attached to any horizontal or vertical surface by one of the six available brackets. Designed to "stay put" in any position, the "Super Seven," fitted with a lens of 7 diopters, costs £13 15s. A similar lamp with a lens of 4 diopters is also available. Price £13 5s. *The 1001 Lamp Co. Ltd., 66 Tyrwhitt Rd, S.E.14.*

Rotary indexing charts

A HELPFUL "Application Chart" for use with their lubricants has been issued by Electrolube. It has a rotary indexing card which gives guidance on 16 varying types of procedure in lubrication. This includes the most advantageous methods by which the lubricants may be applied. *Electrolube Ltd, Oxford Avenue, Slough.*

REACTOR FOR POWER CONTROL

SUITABLE for regulating power in electric heaters and furnaces is a new range of "c" core saturable reactors, known as Series 5181B. Recently introduced by Electro Methods Ltd., the unit consists of specially wound a.c. and d.c. bobbins through the centre of which pass high-grade strip wound "c" cores to form a three-limb construction. This assembly is rigidly held by aluminium channel and tie rods, providing on the top channel a mounting for the terminal block. All coils are fully cotton taped and varnish impregnated.

It is claimed that careful design and correct attention to core balancing ensure that the level of harmonic and fundamental voltages generated in the four signal windings is kept to a minimum. By using three signal windings in series a control signal of between 165 V and 180 V d.c. will be required. This corresponds with the output voltage normally obtainable with many mains operated magnetic amplifiers and, therefore, the fourth signal winding becomes available for biasing purposes. Some variation in maximum output voltage will occur between units, but the output will never be less than 215 V on a 240 V supply when connected to the correct load resistance.

Standard types of these reactors are available in sizes up to 12 kVA. *Electro Methods Ltd., Caxton Way, Stevenage, Herts.*

Container level indicator

DESIGNED to facilitate the measurement of materials in large containers is the "Quantimeter," introduced by Lancashire Dynamo. It is intended to provide a continuous indication of the level of stocks either on the exterior of the container or at a remote control data-recording point. The "Quantimeter" operates on the principle of changing electrical capacitance as material builds up along the length of wire electrode installed in the container. The change in capacitance is measured within the equipment and displayed on an indicating panel which may be calibrated in appropriate units. A feature of this unit is said to be the inherent compensation against indicational errors caused by variations in the moisture content of materials. Six capacitance ranges are provided to ensure that the equipment can be used on a wide variety of materials. *Lancashire Dynamo Electronic Products Ltd., Rugeley, Staffs.*

Magnetostriction delay lines

MAGNETOSTRICTION delay lines, designed for the dynamic storage of pulse information for periods of 5 microsec up to 1½ millisec, comprise a nickel tube terminating in matched p.v.c. loads with ferrite-core coil transducers mounted on the tube. Adjustment of the distance between the transducers provides variation of the delay time which is transmitted between them by normal magnetostriction of the core. The scaled metal containers also provide shielding between the delay line and adjacent circuits. In an alternative application a number of output transducers can be mounted on a single core, providing sequential pulses originating from a single input transducer. *Cossor Radar and Electronics Ltd., The Pinnacles, Harlow, Essex.*

Cable glands

NEW, adjustable cable glands designed to allow for unavoidable variations in cable dimensions, but which ensures full engagement between the gland component threads at all times are announced by Cable Covers Ltd., London. The gland is made from 30-40 ton manganese-bronze and a small range, seven in all, covers cable sizes from 3/0·029 to 61/0·103 in a range of voltages from 250 to 3,300. *Cable Covers Ltd., St. Stephen's Hse, S.W.1.*

Hydraulic cable cutter

A HYDRAULICALLY operated cable cutter which is said to cut through 2 in. dia h.v. copper or aluminium cable has been designed by Blackhawk. Time saving is claimed to be a feature of this tool which takes 1 min to cut cable of maximum dia and this is said to include assembly time. It cuts cable cleanly and thus facilitates speedy marrying-up.

The pump itself is remote from the cutter and is connected by a flexible line. By this method it is possible for cutting to be done in otherwise difficult and inaccessible areas. Once engaged, the cutter stays in position until the pump is operated. *Blackhawk Ltd., Acton.*

Stabilised power unit

A STABILISED power unit with two separate and independent 300 V d.c. outputs has been announced by Experitron. It operates from a 200 V to 240 V a.c. 50 c/s single-phase input. Maximum current available from each output is 200 mA and it is stabilised to ±0·2% for nil to full load. At the same time the unit will cope with an input voltage fluctuation of up to ±5%. Hum and ripple levels are low. The unit has been designed so that five can be assembled in a standard 19 in. rack mounting. Each unit measures 6 in. high by 3½ in. wide and 15½ in. deep. There are voltage and current monitoring sockets on the face of the unit and meters can be fitted as extras. The unit can also be supplied with a variable voltage swing of 200 V to 300 V at each output. *Experitron, 165 Young St, Sheffield 1.*

Plastics film capacitors

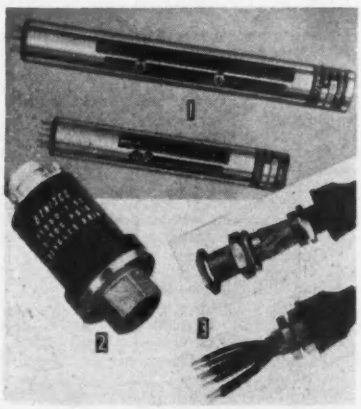
SEALED tubular capacitors incorporating polyester or polystyrene film dielectric are now offered by Salford Electrical. The polyester dielectric types are available in the range 0·05 mF to 2 mF, with a rated d.c. working voltage of 150. It is known as the Type A596 and is of sealed construction. The A597 is encapsulated, polystyrene dielectric in the range 150 pF to 0·51 mF at d.c. ratings from 125 V up to 2 kV. *Salford Electrical Instruments, Salford 3.*

Pressure transducers

THERE are many occasions on which a compact device for converting a pressure into a warning signal or other electrical indication is of use to an engineer. A range of such devices is now available under the name "Dynisco." These are one-hole fixing units, clearly marked with the operational range and with electrical connections suitable for a 25 V circuit. *Industrial Instrument Services, Elkington St, Aston, Birmingham.*

Medium power flash welder

DESIGNED to reduce operator fatigue on long production runs on medium power flash or butt welding, a new hand-operated welder is fitted with pneumatic clamping to give semi-automatic operation. The nominal rating is 30 kVA, with a peak upsetting power of 90 kVA. The moving table is controlled by hand lever and quadrant assembly and will handle tubes up to 1½ sq in. and flats to 1·8 in. *Electro Mechan-heat Ltd., Manor Wks, Bilston, Staffs.*



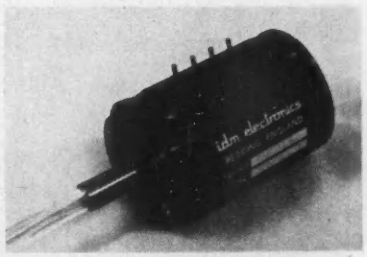
1, Cossor magnetostriction delay line units for dynamic pulse storage; 2, The Dynisco pressure transducer rated at 0·750 lb/sq in. on 25 V systems; 3, Cable glands by Cable Covers

Measurements from Rotating Parts

DESIGNED specifically for transmission of strain gauge or thermocouple readings from rotating parts, the first of a standard range of precision slip-ring assemblies has been announced. Mounted in a 1½ in. dia synchro-type housing, the assembly is reversible and has eight or 12 separate circuits which have external terminal connections. Assemblies with a marker ring for counting purposes or with special lead wires for critical thermocouple applications are also available.

It is claimed that by using small diameter electro-deposited silver rings and two brushes per ring, each of silver graphite, electrical noise levels of less than 3 microvolt/mA are achieved at speeds up to 3,000 r.p.m. The life of the unit is in excess of 1,000 hr at 3,000 r.p.m., after which time it may be returned for servicing. The maximum recommended speed is 10,000 r.p.m. The manufacturers also state that the contact resistance, including leads, is 0·07 ohm/circuit and insulation resistance between circuits is better than 200 megohm at 500 V d.c.

Weighing only 4·8 oz, the assemblies may be cantilever mounted from the end of a shaft with a simple torque arm preventing rotation of the housing or for high-speed applications clamped rigidly to a base plate and the shaft driven through a flexible coupling. *IDM Electronics Ltd., Whitley Kiln, Basingstoke Rd, Reading, Berks.*



Precision slip-ring assembly designed for strain gauge or thermocouple readings from rotating parts

Non-lethal tester

DESIGNED for use on assembly lines, an a.c. flash tester has been recently announced having a maximum test current of only 1 mA. The instrument comprises a variable voltage potentiometer, with a range up to 5 kV 50 c/s, and a test voltmeter. Housed in a steel case with a carrying handle, the unit weighs 20 lb and is complete with h.v. probe and earth lead. *Witton Electronics Ltd., Bickford Rd, Birmingham 6.*

Powered bar bender

A SEMI-AUTOMATIC machine, designed to bend black mild-steel bars up to 1¼ in. capacity, has been introduced recently by Staffa. The unit is also said to be able to bend similar sections cold and arrangements can be made for multiple bending of smaller sections. Of robust construction, the frame is constructed of steel and all gearing is machine cut. Power is provided by a 3 h.p. drip-proof motor on an adjustable tensioning table. The three-way control handle is fitted for forward, neutral and reverse positions. A rotating roller attached to the plate is controlled for angle of bend by means of a pin, which can be placed in any of the holes provided to suit requirements. In order to obtain maximum bending speed, three pulleys are provided in an accessible guarded position. *Chamberlain Industries Ltd., 3 Buckingham Palace Gdns, S.W.1.*

'Fridge for building-in

DESIGNED to meet the need for bigger capacity food storage spaces in compact kitchen layouts is the latest Electrolux refrigerator M40. This model is intended mainly for estate developers and local authorities through normal distribution channels. It has a capacity of 4 cu ft and there are three shelves, one having a hinged flap for storage of tall bottles. Further bottle-storage space is provided in the door liner, which also has butter and cheese compartments. The enclosed low temperature compartment will hold 7 lb frozen food. The price is 55 gns. *Electrolux Ltd., 153-155 Regent St, W.1.*

Electrolux M40 built-in 'fridge with 4 cu ft capacity

Pipe lagging

A NEW form of domestic pipe lagging has been announced by the makers of "Thermos" insulation. It is said to be clean in appearance, as it is constructed of white p.v.c., filled with mineral fibre. The lagging is claimed to be easy to fit and have an attractive waterproof finish. It is marketed under the name of "Thermos Pipewrap." *Hodgson and Hodgson Ltd., Derby Rd, Burton-on-Trent.*

Transistor switching equipment

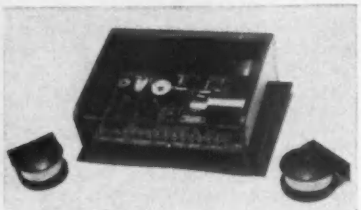
A NEW range of transistorised switching equipment to replace existing conventional mechanical limit switches has been designed by the Electronics Division of Bruce Peebles Ltd. Operation of the switching system is based on the variation of an inductance in the detector head with the approach of a non-ferrous material. This change is used to unbalance an associated bridge network and the resultant error-voltage output is then fed into a transistor switching amplifier.

This operates a miniature sealed relay for the direct control of valves, motor starters and external contactors. Depending on the application of the system, alternative contact sets can be made avaliable on the miniature relay.

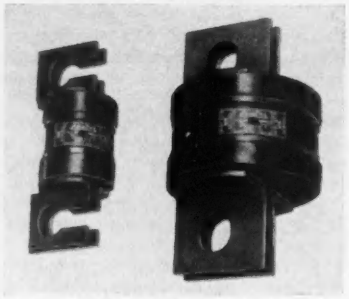
The proximity detector switch can be situated in a position remote from the switching amplifier to eliminate deviation from the characteristic high standard of functional accuracy which may result from extremely high ambient temperatures. *Bruce Peebles and Co. Ltd., East Pilton, Edinburgh 15.*

Transistorised alarm

A TRANSISTORISED detector system using 22 kc/s sound waves has been developed by Electronic Laboratories. It emits inaudible soundwaves which are said to cover the whole volume of a room. The ultrasonic waves build up a standing wave pattern and return echoes are received by a transducer. The instrument is maintained in a steady and balanced immobility and should the wave pattern be disturbed the contacts of a relay close and the alarm is set in motion. Called "Sonalarm," the instrument will also react to fire as the moving flame disturbs the sound waves. The unit operates from mains supply but, should this be cut, "Sonalarm" continues to operate from a battery for several hours; at the end of this time it will sound the alarm. The instrument incorporates an automatic sensitivity control which operates on a system similar to the volume control of a radio set. Therefore it will adjust itself to take some account of either an empty or full storage area. *Electronic Laboratories (Hendon) Ltd., Granville Rd, N.W.2.*



"Sonalarm" ultrasonic detector uses a 22 kc/s sound wave



New range of fuse-links with high breaking capacity

Wider range of h.b.c. fuse-links

RECENTLY introduced, the Aeroflex-Deelynk range of fuse-links provides an extension for installations when exceptionally high breaking capacities are required. For use in substation boards and link-type fuse boxes, they are interchangeable with other fuse-links having standard fixing centres.

This addition to the Aeroflex range has a proved breaking capacity of 35 MVA and is certified to the requirements of BS 88:1952. The fuse-links have also a standard fusing factor throughout the range of 1·25 complying with Class P of that specification.

Features include the fitting of indicators and the rewirability characteristic common to all Aeroflex fuse-links. Fuse-ratings for the units range up to 300 A with 3 in. fixing centres, 600 A with 3½ in. fixing centres, and 800 A with 3⅝ in. fixing centres. *Parmiter, Hope and Sugden Ltd., Longsight, Manchester.*

TRADE PUBLICATIONS

GRIFFIN.—Two leaflets describing stirrers and analytical weights for laboratory use. Griffin and George Group Ltd., Ealing Rd, Alperton, Wembley.

CAMBRIDGE INSTRUMENTS.—New 16-page brochure describing range of hygroscopic and wet and dry bulb humidity indicators. Cambridge Instrument Co. Ltd., 13 Grosvenor Pl, S.W.1.

VACUUM RESEARCH.—Leaflet detailing high vacuum valves with unobstructed bore. Vacuum Research (Cambridge) Ltd., Quayside, Cambridge.

ROTAX.—Leaflets on engine indicator for internal combustion engines and automatic fuel consumption measuring system. Rotax Ltd., Willesden Junction, N.W.10.

GLENIFFER.—Pamphlet giving details of diesel engines by Gleniffer Engines Ltd., Anniesland, Glasgow W.3.

PLESSEY.—Illustrated brochure on ceramic valveholders. Plessey Co. Ltd., Ilford, Essex.

ALUMINIUM DEVELOPMENT.—Profusely illustrated booklet, "Aluminium Bright Trim," priced 10s 6d. Aluminium Development Association, 33 Grosvenor St, W.1.

EMI.—Pamphlet describing transportable magnetic tape recorder. Also illustrated booklet on closed circuit television. EMI Electronics Ltd., Hayes, Middx.

News of the Week

Will Government Intervene on Earthing?

Sir Robertson King calls for action by Area Boards

UNLESS the supply industry or some of its associated organisations accept responsibility for earthing, the Government will sooner or later intervene. This was forecast by Sir Robertson King, Electricity Council chairman, when he spoke at a luncheon following the a.g.m. of the NICEIC last week. Trouble with earthing, he said, was the main reason installations today were not as good as they should be. Area boards had considered themselves kind and generous for letting contractors earth to the board system. Sir Robertson implied that they would have to go much further. Nothing was so dangerous, he said, than to have three-pin installations "only to know that the earth pin is to all intents and purposes dormant and dead."

Sir Robertson also expressed concern with old installations, reflecting that the NIC only covered new installation work. Here again, he predicted that area boards would have to accept responsibility.

The NIC, he said, had gone from strength to strength. Backing this opinion are statistics issued to the a.g.m. During the 12 months ended 31 Oct., 366 applications for enrolment were received, compared with 300 in the previous 12 months; 256 applications were approved and 48 rejected; 573 inspections of new applicants' work were carried out, and 3,508 routine inspections.

One hundred and forty-seven local authorities and other statutory bodies are known to be allocating work exclusively to NIC-approved contractors, compared with 76 a year ago. Brigadier W. Thompson, the chief executive officer of the NIC, thinks the number of authorities who will only add new contractors to their tender list if they are NIC-approved is twice as large.

Speaking after the meeting, Mr S. E. Goodall, chairman of the National Inspection Board, said that penetration into electrical contracting as a whole was not as great as the NIC would like. This was in part because of the number of one-man businesses that came and went. However, the NIC was now receiving "quite a considerable proportion" of applications from one- and two-man businesses.

Amongst matters approved by the a.g.m. was an increase in the annual registration fee to 4½ gn, as from 1 April next.

Aron sale goes through

SHAREHOLDERS have approved of the sale of the pioneer Aron meter business to Ferranti Ltd. This was the effect of a resolution they passed this month to change the name of the company from Aron Meters Ltd. to Astaron Electronics Ltd., which will concentrate on making timers and other electro-mechanical and electronic devices. As a result of the £440,000 deal, involving mainly goodwill, Aron Meters Ltd. becomes the name of a Ferranti subsidiary, along with Aron Meters (Ireland) Ltd. For the time being, Ferranti will continue to make Aron meters at Kilburn, but added economies of scale are one of the major advantages to be gained from the purchase.

ANTI-COMMUNISTS WIN 9-2 IN E.T.U. ELECTION

COMMUNIST domination of the executive council of the Electrical Trades Union has been broken by the recent elections, when their opponents won nine of the 11 seats, as was earlier forecast. The results were announced last week-end by the president, Mr F. Foulkes. But the change does not mean an end to the squabble between the two factions. If anything, it may become stronger in the near future, for the new executive council does not take over until 1 Jan. next, and the Rules Revision Conference (the likely scene of many changes) is scheduled for next week. In the meantime, with Mr J. Byrne, the general secretary, still in hospital, Mr R. McLennan has been appointed as acting general secretary. Mr McLennan was one of five defendants in the recent High Court action who were found to have conspired in the elections for the general secretary.

Mr F. Chapple is to seek an injunction to restrain the Union from holding the Rules Revision Conference next week, or failing that, to have any decisions taken there ruled void.

Colston and Bloom Form Joint Company

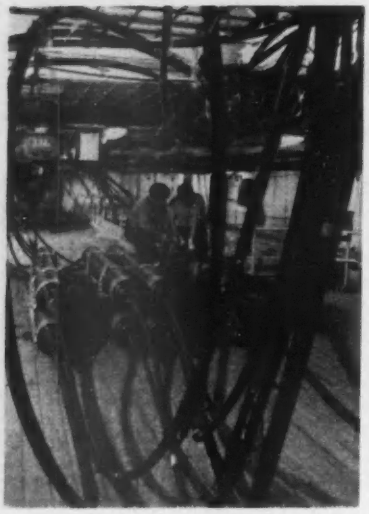
A NEW £250,000 concern, with the title of Rolls-Colston Appliances Ltd., has been formed jointly by Sir Charles Colston (ex-Hoover chief) and Mr J. Bloom (of Rolls Electromatic) along with Mr R. R. Harris, M.P., the present chairman of Rolls Razor. The intention is to make a major attack on the domestic appliance market by direct-sales methods. The first machines will be a dishwasher at 49 gn, and a version of the Colston machine for "over £60."

Rolls-Colston are acquiring the High Wycombe premises, plant and stock of Chas. Colston and manufacturing rights.

Sir Charles Colston will be chairman and joint managing director of the new company with Mr Harris as deputy chairman and Mr J. Bloom as joint managing director. Mr H. Oppenheim, chairman of City Wall Properties Ltd., is joining the Rolls Razor board. According to Mr Bloom, the significance of this was a move by Rolls into discount stores, the first of which will open at Ilford next January. Rolls Razor are also to purchase Mr Bloom's Electromatic Washing Machine business.

More Talks on Supply Claim

WITH further discussions on the pay claim for manual workers in the electricity supply industry expected to take place yesterday and today, 16 Nov., the threat of early strike action has diminished considerably. The wiser council of the major union officials now seems likely to prevail—they have not followed the example of the ETU executive in endorsing the recommendation for strike action. But after their meeting last Friday three union chiefs, Sir Thomas Williamson, Mr F. Cousins and Mr W. J. Tudor, stressed that they were determined to defend the legitimate interest of their members in the present negotiations. The negotiating officers of these unions are continuing their efforts to find a satisfactory solution. In effect, the deadlock has been averted and discussions can proceed.



Securing the last repeater on board HMTS Alert, *ready for laying the northern sector of the Scotland-Faroes-Iceland telephone cable. The repeaters were made by Standard Telephones and Cables Ltd.*

Bulk Supply For British Aluminium

UNDER a new agreement with the North of Scotland Hydro-Electric Board, the British Aluminium Co. Ltd. is to take large blocks of power from the Highland grid when needed. As a result, the company is not to proceed with a scheme to install diesel generating plant. The arrangement will enable the company to maintain a steadier load of operations at its Lochaber and Kinlochleven aluminium smelting works.

The amount of power covered by the agreement is 8 MW, the primary object being to support the company's own generating plant during dry periods in supplying the electrolytic smelters. Plans for the diesel generating equipment, which will no longer be required, had not been finalised.

Lydd–Bolney Line Inquiry Ends

THE six-day hearing into proposals for the supergrid line from Lydd, Kent, to Bolney, Sussex, ended at Lewes last Thursday with a strong reply to certain objectors by Mr S. B. R. Cooke, on behalf of the CEGB. Reviewing the comparative cost of underground, submarine and overhead cables, he said that to place the line underground was impossible on economic grounds. The CEGB had been criticised for failing to break down the estimated £50 million cost of an underground line into terms of cost/unit to the consumer. The total annual budget of the Board was under £400 million, and the East Sussex scheme was only one of dozens of projects; £50 million on that budget was out of the question. It would be a formidable contribution to inflation if expenditure of that kind was going to be envisaged all over the country. Calculations of the cost/unit involved in £50 million were really immaterial, he emphasised.

Referring to criticism by some objectors of lack of publicity about the proposed route and the inquiry, Mr Cooke pointed out that the statutory procedure laid down by Parliament had been complied with. On a suggestion by Battle RDC that planning permission should be obtained for every pylon, he said the Board were prepared to enter into the fullest possible consultation with local authorities concerning the exact siting of pylons.

The inspectors, who conducted the inquiry, Mr A. F. H. Linton, of the Ministry of Power, and Mr E. L. Crawford, of the Ministry of Housing and Local Government, are to inspect the alternative routes proposed for the over 50-mile long transmission line.

Balance of Estate Sold

TWINEHAM Grange, the 367-acre estate at Bolney, Sussex, which was bought by the CEGB a few months ago with the object of using part of the land as a 400 kV substation, has been sold again. The Board have retained about 99 acres, of which 59 acres will be used for the substation. The remainder of the property, 268 acres including Twineham Grange itself, has been sold to a client of H. J. Burt and Son, of Steyning.

OFFICIAL PUBLICATIONS

A Look at Japan. Report of visit by Sir Norman Kipping. FBI, 10s (see page 747).

British Standard amendment slips: 922 and 1691, Electrical Refrigerators and Food Freezers for Household use, PD 4356, 3456, The Testing and Approval of Domestic Electrical Appliances: Part B, Motor Operated Appliances, Section B3, Electric Dry Shavers, PD 4314.

OBJECTION AT GLEN NEVIS

NINE amenity and recreational organisations are objecting through the National Trust for Scotland to the proposed Glen Nevis hydro-electric scheme. It was their request that caused the Secretary of State for Scotland to postpone the public inquiry into the scheme until the report of the Mackenzie Committee, the Commons were told on Wednesday last week. This report will be made in the middle of next year, as stated in our 26 Oct. issue.

The Secretary of State originally thought the amenity arguments could be considered separately from financial and technical questions on their own merits. It was later made clear to him by some of the organisations concerned that their arguments could not be fully deployed without reference to the Committee's report.

The H-E Board had the secretary's approval to proceed with preparatory work on schemes for 1966-67. This should minimise delay in any further hydro-electric developments which may be subsequent to the Mackenzie Committee's report.

Conservative Ideas for Consumer Protection

. . . not so conservative

BOARD of Trade registration and inspection of independent testing organisations is recommended in a Conservative Political Centre publication issued last week. The work of a group including three MP's, under the chairmanship of Mr P. Goodhart, MP for Beckenham, the report also calls for registration and inspection of organisations who issue guarantee seals, certification marks and the like. However, it comes down against Government subsidies for independent testing organisations, even though it has suggested that the annual Government grant to BSI should be heavily increased.

The report calls for compulsory safety standards for a wide range of consumer goods, to be reviewed frequently. Quality standards should in general be voluntary.

The report suggests that the Hire Purchase Act should be extended to apply to all agreements involving goods worth £1,000 or less, and that no h.p. agreement should become binding until 48 hours after signature. H.P. agreements should always incorporate a cash deposit.

Enforcement of consumer protection legislation, the committee thinks, should be carried out at local level normally by counties and county boroughs.

The report, which, speaks disparagingly of consumers consultative councils, is available from the Conservative Political Centre, 33 Smith Sq. S.W.1. price 2s.

Retail Sales Steady

NO change in the level of retail sales in October, on a seasonally adjusted basis, is indicated by BoT preliminary estimates. Without the seasonal adjustment, sales are about 5% higher than in September. Once again in October, trading is about 3% higher than a year ago, but most of this is accounted for by the rise in prices.

LOWER INTEREST FOR EXPORT CREDITS

THE Government were urged to grant lower rates of interest for export credits when the Export Guarantees Bill was given its second reading on Friday. It was suggested that unless better terms than at present were made available to exporting concerns, British exporters would suffer a handicap.

In America, the authorities make interest rates for external purposes to some extent independent of internal rates. This was also the case in France and Belgium. With this in mind the suggestion was made that the Bank of England should follow suit.

Differential rates would not, said the Minister of State, Board of Trade, be a breach of the General Agreement on Tariffs and Trade provided the rate of interest available for exporters was not lower than the rate which the government concerned had to pay in order to raise the necessary funds. The Government are examining opportunities for further action over the provision of finance for exports, both the availability and rate rather than credit insurance.

Guarantees were also referred to in Parliament during the week when the Chancellor said that small firms can now gain assistance from the Export Credit Guarantee Dept. These firms are not now required to cover their whole turnover with the ECGD, but can get cover for transactions with individually approved firms. Recent figures show that BoT services in giving information and assistance to exporters in this country has doubled in volume over the same period last year.

Direct tax relief as an incentive to exporters is not practicable and would be contrary to international obligations.

On the other hand, neither is a turnover tax, such as operated in Germany, acceptable. This system is calculated to raise the cost of living by 1% for every 1% turnover tax.

Pay Pause Review Next Year

Turning to the pay pause, the Chancellor told MP's last week that he does not think that increases in personal incomes are justified this year. When figures for 1960 become available the situation will be looked into. If, however, the pause is not accepted and personal incomes rise faster than the rate of production, we will price ourselves out of our market. On top of this, there will be difficulty in sustaining the balance of payments.

Apprentice Training Linked to Contracts

GLASGOW Corporation have decided to ask firm's tendering for building work valued at £10,000 and over to supply details of their apprentices' day-release schemes. This has been done to ensure that employers are properly fulfilling their obligations, MP's were told on Wednesday last week. The Secretary of State for Scotland was asked if he would approach other local authorities and public bodies to follow this example. He said that this suggestion was made to a committee, whose report he awaited. He pointed out that there is some doubt whether a practice of this kind will, normally speaking, be consistent with the general rule that contracts should be awarded after open competition.

255 B.E.A.B. Approvals in First Year

DURING its first year of operation, BEAB have tested 482 appliances and announce a further list of approved domestic appliances. The introduction of this list marks the termination of the Board's first year. The Board received a total of 549 applications, of which 67 were withdrawn. Of the remainder, approval was granted to 255 appliances, but this did not mean that the balance failed irrevocably, since many modified samples were resubmitted. Appliances now in the scheme include radiant fires, vacuum cleaners, kettles, shavers, toasters and wash boilers. Also in the list are coffee percolators, irons, hair dryers, immersion heaters and refrigerators. The completion of the first year of the scheme means that BEAB is now able to accept, at any time, applications for approval for any appliance in the above list. Further appliances will be tested as soon as specifications in the BS 3456 series become available.

APPROVED APPLIANCES

FIRES—Homefyre Ltd.: 750 W Merrifire; 1 kW Merrifire. *Robson Products Ltd.*: 1 kW Prova. *H. Frost and Co. Ltd.*: 3 kW Sunhouse; 2 kW Sunhouse. *Ekco Heating and Electrical Ltd.*: 2 kW Corona; 3 kW Corona. *T. Price and Son (Stampers) Ltd.*: 2 kW Prilect; 600 W Prilect. *Dimplex Ltd.*: 2·25 kW IRF225. *Falk Stadelmann and Co. Ltd.*: 750 W Falcon. *Morphy-Richards (Cray) Ltd.*: 2 kW Solway. *Berry's Electric Ltd.*: 3 kW Mayberry. *G.E.C. (Domestic Equipment) Ltd.*: 2 kW D.2778.

TOASTERS—H.M.V. Domestic Appliances Ltd.: Automatic TIA.

VACUUM CLEANERS—H.M.V. Domestic Appliances Ltd.: V.1. *Siroma Engineering Co. Ltd.*: 2000.

WASHBOILERS—Brunlec Appliances Ltd: 560 3 kW; 560C, 3 kW.

KETTLES—Best Products Ltd.: Suffolk 1·5 kW, 2·0 kW and 2·5 kW.

P.L.A. TILBURY POWER SYSTEM MODERNISED

SINCE the end of the war, demands for power at Tilbury Docks, Port of London Authority, has increased to a point at which existing availability was being reached. In 1959 a new £250,000 distribution system was authorised, and this month it was officially inaugurated by Councillor S. G. S. Gooderham, chairman of Thurrock UDC. At that ceremony, Mr D. J. Agnew, Thurrock district manager of the Eastern Electricity Board, explained that the old rotary converters had been running since 1926.

Power is now supplied from the EEB at 33 kV and transformed down to 11 kV before feeding into the underground main ringing the docks. Five substations reduce the power to 415 V three-phase and two substations have mercury-arc rectifiers for supplying d.c. at 500 V. The new system's capacity is 8 MVA.

CARAVAN HOMES FOR TROOPS

TO relieve housing shortage for British troops in Germany, the Army have ordered 200 electrically equipped caravans. They are 30 ft long and fully furnished. The contract has been placed with the Bluebird Co. The kitchen is fitted with units and equipped with a Baby "Belling" cooker and "Prestcold" refrigerator. Both the lounge and twin bedroom have fitted electric fires. To conserve heat and prepare for German winters the caravans are to be completely insulated. French doors leading on to an attractive veranda are a feature of these vehicles, which are likely to be moved from area to area as more permanent houses are built. They will be sited mainly in existing barrack areas.

One of the 200 caravans fully equipped with electrical appliances and circular fluorescent lighting fittings

Hospital Lighting Symposium

A ONE-DAY symposium on hospital lighting, under the auspices of the Ministry of Health and the DSIR Building Research Station, is to be held at University College, Gower St, W.C.1, on 5 Jan. next. Papers on various aspects of the subject will be given, to be follower by a discussion. Cost of the course is 1 gn, tickets being obtainable from Miss J. M. Beauchamp, at the Ministry of Health, Savile Row, W.1.

Conference on Microwave Circuits

A CONFERENCE on components for microwave circuits is being organised by the Electronics and Communications Section of the IEE. It will take place in September next year and a scientific exhibition on the same subject will run concurrently. This conference is a sequel to one on microwave techniques held earlier this year.

No Nuclear Ship Yet

WHILE it would be technically feasible to build a nuclear-powered ship now, nuclear propulsion for marine purposes does not offer sufficient economic promise to justify building a merchant ship at present. Instead, the Government have decided to authorise a vigorous programme of research, the Commons were told last week. This programme would be aimed at a reactor system which is economically attractive to a wide range of shipping, and will be carried out by UKAEA in conjunction with industry.

ONE VOICE FOR LIGHTING?

STATESMEN of the lighting industry should give serious consideration to the formation of one body to speak for the profession. This proposal was made by Dr W. E. Harper when he toasted the Lightmongers at their annual dinner, held last week in the Livery Hall of the Guildhall. Earlier he had warned that, although in the past the industry had been characterised by its technical fervour, unless initiative was maintained, it would be wrested from lighting engineers by architects and other professions. The response for the Lightmongers was made by the retiring president, Mr R. V. Stephens, who later introduced the president for the coming year, Mr C. Dykes-Brown, F.I.E.S. Mr Stephens also presented cheques to the Royal Commercial Travellers' Schools and also to the EIBA. The toast, "The Guests," was proposed by Mr C. Dykes-Brown and the reply was by Mr F. J. Burns, A.R.C.O.

Mr R. V. Stephens, left, congratulates the new president, Mr C. Dykes-Brown

WORLD STANDARDS FOR ELECTRONICS SOUGHT

NEARLY 200 delegates from 16 countries are meeting in London this week and next in an effort to initiate world standards for electronics. The representatives, including Americans and Russians, are gathered at British Standards Hse under the auspices of the International Electrotechnical Commission. They are discussing standards for such equipment as valve components, printed wiring and computers.

Setback for Lighting Engineers

IT has been pointed out to us that the article under the above heading in last week's ELECTRICAL TIMES (page 703) implies that recommendations concerned with office lighting in the IES Code were drawn up with an eye on impending legislation. This is, of course, not the case. The IES recommendations have been under constant review ever since they were first issued in 1936. The recommendations in the recently issued revision of the Code are effective irrespective of any legislation.

S.T.C. take over Two Consortium Co.'s

THE shake-up among the telephone equipment manufacturers in the original "Consortium of Seven" continues, with STC announcing that they have acquired the whole of the capital of two operating companies of Phoenix Telephone and Electric Holdings Ltd. The business of both of the new STC subsidiaries, Phoenix Internal Telephone Systems Ltd. and The Private Telephone and Electric Co. Ltd., is the hire and maintenance of private telephone equipment. Their operations will now be carried on by the Private Communication Equipment Division of STC, one of the largest companies in the Commonwealth concerned with telecommunications.

The "Consortium of Seven," comprising AEI, ATE, Ericsson, GEC, EE (through Marconi), Plessey and STC, was formed to fight out with Pye the battle for Telephone Manufacturing Co. They lost this battle but subsequently took over Phoenix Telephone and Electric through a jointly formed holding company, Combined Telephone Holdings Ltd. Since then the situation has changed again through the recent merger of ATE and Ericsson into Plessey.

ALTHOUGH the expected office lighting legislation has been postponed, the series of office lighting exhibitions and conferences arranged by the various regions of the British Lighting Council in conjunction with the electricity boards and manufacturers attracted great interest throughout the country. Our picture, right, shows the display at the Headrow service centre, Leeds, of the Yorkshire Electricity Board. Above, the Lord Mayor of Birmingham, Alderman E. E. Mole, O.B.E., discusses his own office lighting problems with the BLC's Central England regional engineer, Mr D. Whipp, Britain's No. 1 secretary, Mrs A. M. Billingsley, and Mr G. R. Hanson, exhibiton chairman, at the Birmingham display.

OFFICE LIGHTING DISPLAYS

Two Firms Shift Production

G.E.C. . . .

PRODUCTION of computers is to replace manufacture of radio and TV sets at the Spon St, Coventry, factory of the General Electric Co. this month. Radio and TV production is being transferred to the Sobell factory in South Wales. The change will mean no redundancy at the Coventry works, rather the reverse, for computer production will need a labour force of 600—100 more than for radio and TV.

BRUCE PEEBLES . . .

PRODUCTION of distribution transformers is to start this week at the new Broxburn factory of Bruce Peebles and Co. The company have taken over an existing 50,000 sq ft factory on a ten-acre site. Mr W. B. Laing, managing director, has said they were moving activities on the smaller transformers to Broxburn in order to deploy the full heavy engineering resources of their East Pilton, Edinburgh, factory for the manufacture of the very large and high voltage transformers. It is planned to employ between 150 and 200 people at the new works in six to nine months' time, and with anticipated expansion the figure could rise to about 400 in three years.

SUN TAKEOVER

SUN Electrical Co. have acquired all the capital of H. W. Gilbert, wholesale electrical distributors of Brentwood, Essex, for £32,500. The price is made up of £24,375 cash and 11,403 Ordinary 5s shares.

Joint co-ordination venture

THE Electric Construction Co. Ltd., the Reliance Electric and Engineering Co., of Cleveland, Ohio, and Schindler-Reliance Electronics Inc., of Dierikon/Lucerne, Switzerland, are co-ordinating their engineering and marketing interests in the industrial electronics, engineered drives and associated fields. The aim is to enable the companies to give an even wider and better customer service and to broaden their research and marketing potential throughout the world.

F.B.I. LOOK AT JAPAN

Japanese Liberalisation Seen as Key to Better Trade

JAPAN has always been different, and now that her industry is comparable in size to that of Britain or Germany, differences that are little understood in this country still remain. As Japan has the fastest growing economy in the world, it was important that these mysteries should be cleared up, and after discussions between the British Government and the FBI had disclosed that some revision of Anglo-Japanese trading relations must be foreseen, the FBI decided on two steps to remedy the situation. They commissioned a thorough market survey by the Economist Intelligence Unit, and they arranged for Sir Norman Kipping, the director-general, and Mr J. R. M. Whitehorn, one of their deputy overseas directors, to visit Japan. The outline report on this visit was issued this week, and the detailed findings by the Economist Intelligence Unit, including where the export opportunities lie, will follow shortly.

First and foremost, Sir Norman and Mr Whitehorn found considerable discrepancy between Japan's announced plan for progressive liberalisation of imports and what has actually taken place. Under pressure from GATT and the IMF, Japan recently decided to accelerate her liberalisation programme so as to free from restrictions goods which accounted for 90% by value of the 1959 import bill. But, says the report, there are items supposedly liberalised that prove on examination to be not so; there are instances of tariff increases cancelling out the effect of liberalisation; and, more serious, were it to be implemented, a Buy Japanese Bill has been proposed which would be the equivalent of an extra tariff of 10% over the whole field of machinery. Moreover, administrative obstructions and delays are still prevalent.

The other side of the coin is the Japanese Government's method of bolstering exports by tax incentives and subsidies, but this probably stems, to a certain extent, from historical attitudes, for peculiarly enough, salesmanship and marketing appear to be one of the least highly developed skills in Japan, and the automatic reaction to sales resistance is price cutting.

However, the Japanese Government's attitude to import liberalisation remains the nub, and if this is satisfactory the report regards the long-term outlook for British exports to Japan as "reasonably promising," with the proportion of finished goods in Japan's total import bill expected to rise to over £800 million by 1970.

In the first eight months of this year, Britain has lifted exports to Japan by 62%, and trade between the two countries is now roughly in balance at £40 million to £50 million a year, but there is considerable leeway to make up in relation to Western competitors. This shows up most conspicuously in the area of technical agreements, where there are a total of only 51 with British companies, whereas the US has 947, West Germany 141, Switzerland 112.

A heady credit climate is one of the peculiarities of the Japanese scene, not in consumer spending as in some Western countries, but in bank lending! The authorities have had to allow over-lending by the banks, typically at 10% or more, and the banks frequently specify that part of a credit shall be put back on time-deposit which in turn backs further loans. Trade credits, too, of 210 days are not uncommon. How long rapid growth can continue to be financed by these methods is a central question in Japan, but it seems to be felt possible so long as growth can be *held down to 7—9% a year.*

CLOCK O' THE NORTH

SIX months' work by a team of craftsmen at Synchronome Co. Ltd., of Alperton, has culminated in a 1½-ton clock which has been erected in Edinburgh for the House of Fraser. No timing mechanism is housed in the automata clock, time keeping and movement of the hands are controlled by a master clock. This master clock is entirely independent of mains supply, being operated from a triple charged accumulator. The chimes, giving a range of 25 notes, are produced by a change in electrical capacity. Any combination of tunes within the compass can be obtained and the output from generating units is taken through conventional type amplifiers to stentors. The exterior of the clock is in the form of a castle and at each quarter chime a pipe major and four pipers—hand-beaten from copper—circumnavigate the clock. At 7½ min past each hour the clock plays "Scotland the Brave" and, at 37½ min past the hour, "Caller Herrin." The chiming is operated from mains supply and in the event of a power failure the chimes will automatically reset to the correct sequence.

Three o'clock at the House of Fraser. This is now Edinburgh's most versatile clock

BIG FLOOR-WARMING SCHEMES

DONCASTER Town Council have approved a recommendation that electric floor-warming should be installed in their proposed new Town Hall, which is to be composed of 13-storey and two-storey blocks as part of the civic centre development.

LONDON County Council Housing Committee have approved plans for the erection of two 11-storey blocks, each of 52 dwellings, with electric floor-warming and 12 one-room bungalows for old people, with electric space heating, at Tidbury St, Battersea. Reema Construction Ltd. are to be asked to enter into a supplemental contract for the scheme.

LARGE ORDERS

THE Isle of Man Electricity Board have placed a repeat order for a Mirrlees/Brush diesel generating set. This is for a 12-cylinder diesel direct coupled to a 2,200 kW Brush alternator for installation at Ramsey power station.

MARCONI's Wireless Telegraph Co. have been awarded a contract worth about £900,000 by the Admiralty for a large number of 500 W medium-frequency/high-frequency independent sideband communication transmitters of a new type, together with high-stability master oscillators, etc.

THE Motor and Control Gear Division of AEI is to supply all the electrical equipment, valued at £150,000, for two cotton ginning and baling factories for the Sudan Gezira Board. AEI have also received another £150,000 order from the State Electricity Commission of Victoria, Australia, for 39 outdoor oil circuit-breakers rated at 66 kV, 2,500 MVA.

Sayings OF THE WEEK

"Nothing is more dangerous than to have three-pin installations only to know that the earth pin is to all intents and purposes dormant and dead." . . . SIR ROBERTSON KING, speaking to the NICEIC.

"Gas has been a sick child but as a result of the last report of the industry it is now definitely in the convalescent stage. All that is now required is a marketing tonic." . . . MR W. R. BOWDEN, chairman, Institute of Marketing and Sales Management, at Gas Council's Sales and Service conference.

"The bigger firms trot out very limited [research] schemes for a Minister's commendation. The smaller firms say they cannot afford it, and trundle along hawking their obsolescent technology through a fast dwindling seller's market." . . . LORD HAILSHAM.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, November 14

	£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	227½	−3½
" (3 months)	227½	−3½
LEAD, refined pig, 99·97% purity (cash)	57½	−4
" (3 months)	58½	−3½
TIN, refined, min. 99·75% purity (settlement)	962½	−7½
(3 months)	967	−1
ALUMINIUM, ingots 99·99·5% ...	186	—
" wire bars (4×4×54")	193½	—
BRASS Strip 63/37	195½	—
SILVER (Troy oz)	80d	—

	£ per ton	Weekly change £
ZINC, virgin, min. 98% purity (cash)	67½	−2½
" (3 months)	68½	−2½
RUBBER, per lb No. 1, RSS, spot	22½d	−½d
c.i.f. basis, ports, Jan. ...	22⅝d	—
ARMOURING: Galv. Steel Wire (0·104 in.) ...	68½	—
Mild Steel Tape (0·04 in.) ...	53½*	—
NICKEL (home)	660	—
MERCURY (76 lb flask)	60	—
AMERICAN PRICES: Copper, electrolytic (per lb) ...	31c	—
Lead (New York)	10c	−¼c

* *Tape Price, now an average, includes varnishing*

FATAL SHOCK FROM WASHER

A COMBINATION of wrong connections and a broken plug on her washing machine resulted in the death of a Matlock housewife, it was stated at the inquest last week when the jury returned a verdict of "misadventure." The 15 A plug had been wired up by the deceased's husband, and Mr F. Shaw, an EMEB engineer, said the green earth lead and the black neutral lead had been transposed, but this in itself would not have caused the trouble. On examination of the main switch of the circuit, he found that the neutral pin was broken and only caused partial contact. This allowed the mains voltage to pass on to the frame of the washing machine. He thought the deceased probably touched the frame at the same time as she touched the sink unit, causing the current to go to earth through her. If the main pin had been functioning properly, the accident would not have happened.

The coroner commented, "If there is any lesson to be learned, it is that people should get electrical installations overhauled by experts."

E.D.A. Issue Safe Wiring Poster

IN time for Fire Prevention Week, though also intended for much more general use, EDA have produced a 10 in. by 15 in. poster and a pocket-sized card asking "Is *your* wiring safe and adequate?" Uniform in design, with the wording boxed in a ring-main within the representation of a house, the poster refers the viewer to the electricity board for advice, while the back of the card lists the do's and don'ts which prevent accidents.

Wiring contract criticised

LEEDS Housing Committee was criticised recently for giving a wiring contract to the Yorkshire Electricity Board without ascertaining whether any other concern could do the job as efficiently, but more cheaply. Referring to the contract, for installation by the YEB of 13 A switched socket-outlets in pre-war Corporation houses, Councillor P. Crotty said he was told the job could be done considerably cheaper, but neither he, nor anyone else, knew for certain, for the only price they had was that of the YEB. He said that the chairman of the Housing Committee, Councillor K. C. Cohen, in a memorandum referring to the matter, had summed up by indicating that it was more economical to let the Board do the whole of the job.

But Councillor Crotty claimed that the housing chairman did not know whether that was, in fact, the case.

News in Brief

N. Scotland HEB are sponsoring another large electrical exhibition, this time at Elgin, from 10 April to 14 April, 1962.

The Economic Council for Europe is organising a national convention at Eastbourne from 29 Nov. to 2 Dec. next.

Hoover Ltd. have chartered a special "Golden Arrow" express on 17 Nov. to take a large party of dealers and their wives to Paris for a four-day visit, part of the prize in connection with their "Housewife of the Year" competition.

The BBC's new TV and v.h.f. sound broadcasting station near Llandrindod Wells will begin operating on 4 Dec.

A symposium on "Mechanical Equipment for Sewage Purification Works" is to be held by the Institution of Mechanical Engineers on 1 Feb., 1962.

Annual ball of the Ipswich and District Electrical Association, at Clacton, was attended by 236 members and guests.

Six h.v. lines and 32 l.v. lines in the N.E. Suffolk and Yarmouth districts have been raised to allow loads to be carried by road from Lowestoft docks to Sizewell nuclear station site. In 17 cases the lines were placed underground.

Liverpool City Council's Parliament Committee have approved the preparation of a Bill enabling the Corporation to produce electricity for sale to MANWEB as part of the Trywerwyn water scheme.

Company Activities

GIVEN the right carrots, stock markets can usually be counted upon to trot investors up on to higher ground—and so it was last week. After a shaky start on consideration of the Chancellor's pending capital gains tax, that same gentleman's more cheerful views on the economy saw the buyers again climbing aboard the equity wagon. It was reported, furthermore that some trustee investors were also moving gingerly into the market. A fine performance by Wall Street was also a factor to encourage UK sentiment and, for electricals in particular, there was quite a spate of encouraging company news.

Some shock and surprise was occasioned early on by the halved profit from British Motor Corporation for its year to 31 July. Although vehicles produced in 1960-61 were only 67,723 fewer at 601,399 units, profit slumped from £31·9 million to £15·5 million before tax and the net profit from £13·3 million to £5·7 million. It looks almost as if the profit margin on the new "Mini's," which have prevented the production figures falling further, must now be comparable to that on a transistor radio! However, with the worst known, the company's 5s Ordinary shares actually changed up from 14s 4½d on the news to 14s 9d and, after starting out the week at 13s 10½d (compared with a 12s 10½d "low" this year), finished at 14s 10½d. Great comfort was taken from the fact that the new chairman, Mr George Harriman, was able to maintain the year's total dividend at 20%.

Against BMC's figures, those of Joseph Lucas, which showed a fall from £7·8 million to £6·4 million (and a net profit after tax down from £2·9 million to £2·5 million), must be considered dazzling. Chairman Sir Arthur Waring was, like Mr Harriman, still able to maintain the 2s 9d total dividend on the £1 Ordinary shares and, rather surprisingly, Lucas actually increased its sales, albeit marginally, in the 12 months to July. These were all tidings good enough to lift the Lucas Ordinaries by 3s 6d a time to 54s, and by the close of the week's business their halo had moved up to 55s 7½d, although there is still a considerable amount of burnishing to do before they re-attain this year's earlier high price of 72s. At 55s 7½d, Lucas £1 Ordinary shares, with the 13¾% dividend still 2·3 times covered, now yield 5%.

There was better news still from BICC whose group net trading profits improved by 18% to £3,321,000. But how about the second six months of this year? Chairman Sir William McFadzean says indications are that the improvement should at least be maintained in the July-December period. After the cable price war of recent times these are indeed encouraging results and comments. Stock market operators thought so. After a 57s 3d start to the week, the £1 BICC Ordinary share first dipped to 56s 9d before the news, climbed to 59s and then eased to 58s.

Providing the week's firework display, newcomer Racal Electronics — radio communications and electronic instruments—whose 5s Ordinary shares were "placed" at 20s 3d rocketed to 28s 6d in first time dealings, went on to 33s 6d but then eased on profit taking to 33s 3d. Elsewhere, EMI jumped from 36s 3d to 38s 6d on the chairman's statement that sales of the group are so far satisfactory and that there is reason to believe they may show an increase over those of the previous year, AEI went better at 33s 9d, English Electric improved from 29s to 30s 6d and even GEC shone up from 26s 6d to 27s 6d. Truly the week of the banger and the sparkler.—*From our City Correspondent.*

Aerialite

"The problems of the cable business are not yet cleared. There is a deliberate policy from our large competitors to depress the prices of cables in certain sections of the market where it suits them and there is nothing at the present time that we can do about it other than to operate more efficiently to increase the profit margin," says the chairman and managing director, Mr L. S. Hargreaves, in his annual report. In the past year, efficiency suffered badly at Stalybridge through shortage of labour, but with these troubles over, and the Congleton factory, home of the infant domestic appliance division and TV aerial side, operating profitably, a better profit has been budgeted for this year. A recent revaluation of properties realised an excess of £535,000 over book value.

Alwyn Holdings

Similarly to other electrical contractors, a strong rise in earnings is reported for the past year. Before tax, profit is up from £186,732 to £232,297, while net profit comes out at £111,077, against £86,868 previously. As forecast, dividend is 15% on bonus-increased capital, and compares with an equivalent 8½% previously.

James Austin

This cordage manufacturer's venture into the electrical sphere through the purchase of Hartley Electromotives has not proved disappointing. Earnings for the year to June have exceeded the anticipated annual rate of £30,000, group chairman Mr R. G. Cooke said at the a.g.m.

BICC

Good progress with the two main aims set by Sir William McFadzean in his last review, to obtain more economic prices for certain products and to achieve the highest efficiency, is revealed by half-way figures for the current year. Group sales advanced to £75 million from £69 million in the second half and £74 million in the first half of 1960. In the present intensely competitive climate, this is a guide to the efficiency aspect, and there is another pointer, expenditure of £118,000 on factory reorganisation in the six months to June against the usual level of around £20,000. On the question of margins, the measure of success is that whereas turnover increased by 1½% from the previous corresponding period, trading profit recovered 18% from £2,823,000 to £3,321,000. Even so, the margin is thin at 4·4% on turnover and Sir William describes the necessity for containing costs as "vital." The significant thing is that on the basis of curent figures the improvement in the six months to June is expected to be at least maintained during the second half. Interim dividend stays at 4% on higher capital.

British Electronic Industries

It is possible to suspect a link between two points made by Mr C. O. Stanley at the annual meeting. The first is on the direction in which the group is going; he said that from the end of the current year BEI hoped to be able to produce profits that would pay dividends irrespective of what happened in the radio and TV side of the business. Asked why Mr E. K. Cole had resigned from the board, Mr Stanley repeated that this was due to differences of opinion in the day-to-day running of the undertaking, and that personal relations were the friendliest possible. Mr Cole, of course, is a radio-TV man if ever there was one.

Burgess Products

The recovery in earnings in 1959-60 went further in the past year, profit moving up from £303,317 to £410,728 before tax of £218,900 (*£157,750*). Dividend is repeated at the 20% rate set in the previous year.

Crabtree Electrical

Net profit has jumped from £206,063 to £259,081 for the year to 31 July, indicating that the rise in turnover has offset a squeeze on margins from the direction of higher costs, and dividend stays at 12½%. The preliminary statement shows a tax provision of £245,468 for the year, against £248,471 on the previous year's lower profit.

Dictograph Telephones

Profit is steady at £326,322 (previously £324,756) before tax, and dividend stays at 20%. After slightly higher tax, net profit comes out at £182,063 (*£183,327*) for the year to 31 Aug.

Dividends Announced

Bakelite. Interim 6% (*same*).

Hattersley (Ormskirk). Interim 5% (*same*).

● *Continued on next page*

Electric and Musical Industries

Sir Joseph Lockwood winds up a wide-ranging review by saying that prospects for the group's sales seem good, and in the year to June, 1962, they may well reach £90 million. He expects profits to be higher, but in the prevailing conditions of intense competition declines to make a forecast. Including both Morphy-Richards and Ardente, but adjusting to give a direct comparison with the period

Year to 30 June	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price*	
			Earned	Paid	High	Low
1957	6,141,000	2,050,000	89·5	15	36/6	23/9
1958	6,792,000	2,577,000	113·8	15	56/6	20/7
1959	6,800,000	2,397,000	74·5	20†	56/10	31/4
1960	7,074,000	2,286,000	39·1	17½‡	59/3	40/3
1961	7,998,000	2,443,000	33.8	17½	52/6	35/1

* Calendar year, except 1961, which is up to 6 Sept. † After one-for-three scrip issue. ‡ After one-for-two scrip issue.

before their acquisition, last year's growth in sales was 2%, bringing overall turnover to £82·4 million. Electronics capital goods did well, but "stop-go" Government policies come under some well-directed fire in relation to domestic appliances. With bank overdrafts standing at £7·7 million in the balance sheet, arrangements are also announced for a £3·3 million Swiss loan to ease the situation.

Hailwood Industries

Although net profit has slipped from £95,208 to £88,457, dividend is maintained at 15% on capital increased by a one-for-two scrip issue, as forecast by directors. The result is after £78,658 tax (*£84,663*).

KG (Holdings)

Some delay in the flotation of the F. H. Wheeler and Co. subsidiary has occurred, the group chairman, Mr P. R. V. Wheeler, mentioned at the a.g.m. This was due to the need to obtain legal opinion on certain aspects of the Articles in relation to Stock Exchange quotation of the shares. It was merely a matter of timing, he said, no major hitch.

Joseph Lucas

The troubles of the motor industry are reflected in a 17% fall in the trading surplus from £7,823,177 to £6,476,846 in the year to 31 July, but this is still better than the market expected after BMC's results and the dividend stays at 13¼%. The direction of the squeeze on earnings is shown to be from costs, for directors report that turnover increased marginally. After tax, net profit comes out at £2,526,350, against £2,923,424 previously.

Plessey

Preliminary results for the year to 30 June show trading profit down from £4,227,597 to £3,422,659, though because of the complex nature of the group's activities, with many long term contracts, the bare figures are by no means the be all and end all. Increments to earnings from price settlements on long term contracts are described as not as high as last year, but still higher than normal. An outstanding feature of the figures is that income from investments, which are largely gilt-edged, has shot up from just over £73,000 to £624,000. This shows that following recent loss and share issues, liquids outweigh at least four times the £2 million cash element to be paid for ATE and Ericsson. Taking into account investment income, and after tax, net profit is down relatively slightly at £1,712,886, against £1,907,850 previously, but minority interests take a larger slice at £139,599, compared with £88,873 a year ago.

Pressed Steel

Unofficial strikes on the car-body side of the business are mainly responsible for omission of the interim dividend and a forecast of "most disappointing" results for 1961, but the refrigerator side has not helped. Refrigerator sales have suffered from price cutting, the chairman reports.

S. Smith and Sons

The unofficial strike which closed the plant in June cost the company something like £340,000, bringing profit down to £2,660,157 for the year to 5 Aug. from £4,190,708 previously. Despite the setback, dividend stays at 20% and is twice covered.

J. and F. Stone Lighting

Some measure of the benefits shareholders are likely to receive from the proposed transfer of the properties to a separate company is given in the balance sheet. The freeholds appear at cost and amount to £850,276, while the leaseholds are at 1935 valuation with additions at cost and are entered at £638,951—a total of £1,489,227 for the 203 branches in good sites throughout the country and the Portadyne factory.

Strand Electric

An unusual story, one of increasing profit margins, is told by chairman Mr J. D. H. Sheridan in his report with the accounts. Outstripping the rapid increase in turnover itself, the profit margin before tax has grown from 8% in 1959 and 9·7m in 1960 to 11·5% last year.

Sun Electrical

The radio boom is reflected in profits, which are up from £150,132 to £181,409 before tax, which is up to the best expectations in view of the difficulties wholesalers have had to face with most appliances. However, directors have adopted a restrained dividend policy, declaring an unchanged 18½%.

Solar Energy to Pre-heat Water

EXTENSIVE electrification may in itself promote the use of direct solar radiation as an auxiliary means of water heating. This was the view expressed last Thursday by Dr H. Heywood, principal of the Woolwich Polytechnic, in addressing the Royal Society of Arts on solar energy developments.

Most of the technical difficulties have been solved as collection of solar radiation as low-grade heat has been accomplished using relatively simple equipment with a resulting collection efficiency in the region of 60%. Individual flat-plate heat collectors are connected by flow and return pipes to a water-storage tank, having a capacity of about 1 gall for each square foot of collector surface. This provides a simple thermo-syphon circuit which has been used successfully in semi-tropical countries, over 10,000 heaters of this type being in use in Israel and about 350,000 units in use in Japan. Heat collectors consisted essentially of a system of water channels combined with areas of flat-plate and could be constructed from corrugated galvanized iron sheets backed by a flat sheet of metal and connected to headers.

Considering solar water heating in temperate climates, Dr Heywood said that although there were difficulties to overcome, investigations showed that a solar heater could perform the initial heating of the water using an ordinary electricity supply to heat the water to the final temperature required. This could possibly halve the cost of electricity required. Economic factors involved were the amount of solar radiation received and the proportion that could be collected as heat, the value of this heat in terms of electricity and the cost of the collector. From data available, it was considered that with a collector costing 20s/sq ft, capital charges could be recovered in four years. Saving in electricity costs could amount to £10/year on a 40 sq ft heater over a life of ten years.

Figures were given showing the results of tests made by Dr Heywood using a thermo-syphon system and these are shown in the accompanying table. From these experiments, it was shown that efficiency of collection could be improved by operating at lower water temperatures and, in this way, heat recoveries of 1,000 B.Th.U./sq ft to 1,500 B.Th.U./sq ft a day could often be obtained during the summer and an appreciable recovery possible on many winter days. The foremost conclusion reached was that the most effective method of utilisation was by pumping water through the heater, preferably with automatic control, so that the flow was stopped during cloudy periods. The warmed water was then fed to an electrical heater to bring the water to the usual temperature of 140°F. Further research was proceeding at Woolwich Polytechnic to provide further data on economical design of equipment.

Table I. Heat collection data

Month in 1949	No. of days	B.Th.U. per sq ft	Max. water temp. °F	Efficacy of collection	Air temp. °F	Bright sun hours
March ...	31	294	85	47	45	2.8
April ...	30	575	123	48	56	5.0
May ...	31	577	124	52	58	4.7
June ...	30	611	131	54	66	4.5

All figures apply to a period 8 hr to 16 hr and show averages for all days.

OVERSEAS NEWS

from our correspondents abroad

CANADA

St. Croix Scheme

The International Joint Commission's recommendations to develop the St. Croix River have been accepted by the federal governments of Canada and the United States. They have accepted suggestions regarding abatement of pollution, development of a power site at Milltown, New Brunswick, and continued studies aimed at possible further development of the river. But implementation of the proposals will necessitate further consultations by the Canadian federal and New Brunswick Governments.

BCPC Deficit

A deficit of $93,000 resulted from operations of the British Columbia Power Commission in the year ended 31 March last—only the second deficit in 16 years' working.

Despite a rise of 5,358 in the number of consumers served, and the rising average use, the annual energy requirements rose only by 0·3%. Of the total of 1,786 million units needed, the Commission's own generating plant provided all but 78 million units, which were purchased. Average annual residential consumption rose by 4·3% to 4,396 units. The new rural electrification assistance programme, aimed to serve 3,000 new consumers at a cost of $5 million in three years, is being successfully carried out at the scheduled rate of connection.

U.S.S.R.

Plan Review

More than 6,000 miles of railway in Russia have now been electrified and half of all the trains use electric or diesel traction. This was reported at the twenty-second Communist Party Congress. The modernisation of railways has provided an economy of about 2½ million roubles in the period under review.

Output of electric power has increased by 157,000 million kWh to a forecast 1961 production of 327,000 million kWh. Domestic appliance production figures also show an increase with 731,000 refrigerators constituting a 480% rise on 1955.

The third hydro-electric power station in the Dnieper chain, Kremenchug, has just been completed bringing the total number of stations on the rivers Volga, Kama and Dnieper to ten. These are working at full capacity and another four are under construction. Concurrent with this, power consumption per industrial worker has risen by at least 40%.

Industrial output in the USSR is said at present to amount to 60% of American output. The following figures are the estimates for 1961.

	USSR	USA
Coal, oil, gas and other fuels (million tons)	724	1,430
Electric power (on the busbars — thousand million kWh)	306	872
Electric power used in industry (thousand million kWh)	213	425

NYASALAND

Move on Nkula

Work on the Nkula Falls hydro-electric scheme, Nyasaland, will almost certainly start next March or April, according to Mr J. Foot, Parliamentary Secretary to the Federal Ministry of Home Affairs. Speaking in Blantyre a few days ago he said there were some matters, including finance, which had yet to be settled, but construction of the project should start not later than the end of the rains. It was the firm intention of the Minister of Power, Sir Malcolm Barrow, to meet the target date planned. The proposed 28 MW power station is to be sited on the Shire River, some 20 miles from Blantyre, and will provide power for the Southern Province, in addition to an extension to Lilongwe. The civil engineering consultants for the project are Kanthack and Partners, with Kennedy and Donkin acting as electrical consultants. A 66 kV power line from Blantyre to Walker's Ferry, just above Nkula Falls, will be completed next year. This will supply power for a pumping station on the Mudi River water scheme.

MALAYA

Station Extension

Two more 20 MW generating sets, together with ancillary plant, are to be installed in the Malim Nawar steam power station of the Perak River Hydro-Electric Power Co., subject to the necessary consents by the Malayan authorities. This step has been decided upon because the earlier hope for a bulk supply from the Central Electricity Board will not be possible for several years to come, due to the increasing demands on the CEB's system. The company itself also achieved a large increase in units generated—over 24%—at a total of 480 million units, reflecting the restored prosperity of the area. The existing Malim Nawar plant provided over 243 million units and the Batu Gajah another 76 million. The remaining portion, nearly 160 million units, was supplied by the Chenderoh water power station, an output 6·6% down on the previous year due to the low rainfall and about 15% lower than is expected in a year of normal rainfall.

Cable Contract

A £330,000 contract for the supply and installation of some 60 miles of cable for the Cameron Highlands scheme has been awarded to British Insulated Callender's Cables Ltd. by the CEB of Malaya. The cables are to be installed at and between the 100 MW Jor station, now under construction, and the proposed 5·5 MW Habu station six miles distant, and at Rawang substation and Connaught Bridge power station. They will include some three miles of 132 kV cable, to be installed in an inclined shaft to the Jor underground station, 25½ miles of 11 kV cable and four miles of 660 V to 1,100 V paper-lead and p.v.c.-insulated power cables. In addition, the contract calls for about 27 miles of control, telephone and axial cables. The work is scheduled for completion by August, 1963.

INDIA

DVC Output

From the sales of electricity produced by its chain of hydro-electric and thermal power stations, the Damodar Valley Corporation earned over Rs 7·83 crores in the year 1960-61, an increase of some Rs 167 lakhs, compared with the previous year. Altogether, the Corporation's plant generated 163·7 million units, an increase of 12% on the total in 1959-60. The hydro stations, Maithon, Panchet and Talaiya, provided 13·6 million, 13·4 million and 900,000 units, respectively, in the year, with the two thermal stations, Bokaro and Durgapur, adding 12·9 million and 590,000 units, respectively.

AUSTRALIA

Future Fuel Supplies

Although sufficient coal in total has already been proved for the new Munmorah power station (for which the first two 350 MW sets were ordered last week), further coal exploration in the Central Lakes district of New South Wales is in progress.

NEW ZEALAND

16% Increase

A record 302 million units were sold by the Auckland Electric Power Board in the three months ended 30 Sept. last —16% higher than the corresponding period of 1960. Consumption in the June quarter was 263 million units, giving a total for the half-year of 565 million units. Mr A. S. Don, general manager, takes this as a clear indication that the Board will reach its end-of-year-target of 1,040 million units. That total, he has pointed out, is more than half the power used by the 27 South Island power authorities. The next three largest suppliers in North Island are: Hutt Valley (358 million units), Wellington (353 million units) and Waitemata (301 million).

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

16 Nov.—Portsmouth C.C. Electrical and/or hot water system installations in Portsea, Eastney and Wymering area houses (divided into groups of 20-40). Applications to Director of Housing, 1 Clarence Parade, Southsea, by above date. Deposit £1.

17 Nov.—Isle of Bute. Separate trades contract 6. Electrical work in eight two-apartment houses in Shore Rd, Port Bannatyne, for Wm. Woodhouse Strain Housing Association Ltd. Applications to architects, F. Burnet, Bell and Ptnrs, 180 Hope St, Glasgow C.2, by above date.

17 Nov.—Malton R.D.C. Provision and fixing of e.l.c.b's in: two houses, Bulmer; ten houses, Hovingham; and ten houses, Slingsby; and for earth wiring to existing socket-outlets in: nine houses, Hovingham, and ten houses, Slingsby. Housing Assistant: D. Thompson, Welham Rd, Norton, Malton.

17 Nov.—Sheffield C.C. Electrical installation including underfloor heating in Occupation Centre, Park Grange Rd. Applications to City Architect, J. L. Womersley, Town Hall, by above date.

20 Nov.—E.B. for N. Ireland. Specification N.I.1729. 33 kV cables and accessories for outgoing feeder circuits at Finaghy substation. Applications to consulting engineers: Kennedy and Donkin, 12 Caxton St, S.W.1, by above date. Deposit £5 5s, made payable to E.B. for N.I.

20 Nov.—Forth Rd Bridge J.B. Supply/installation/connecting up of 192 200 W and 140 W sodium lamps on 35 ft and 25 ft steel columns, together with special lighting and illuminated bollards for approach roads lighting.—See 2 Nov. issue.

20 Nov.—Ipswich C.B.C. Erection of 82 Group "A" steel and concrete columns and provision/erection of 140 W and 85 W sodium lanterns/lamps/gear.—See 9 Nov. issue.

20 Nov.—Manchester C.C. Contracts 326A, B and C, Communal TV distribution installations in 575 maisonnettes and flats, Miles Platting.—Advertised 2 Nov. issue.

20 Nov.—Tamworth B.C. Supply, erection and wiring complete of 200 W sodium lighting units: (1) ten on 30 ft steel columns; (2) two on 23 ft steel columns; (3) one on 28 ft 6in. column; (4) two on existing columns.—Advertised 9 Nov. issue.

20 Nov.—West Cumberland Water Board. 1,500 g.p.m. at 75 ft head pumps.—See 2 Nov. issue.

20 Nov.—West Riding C.C. Conversion of Thorne Swing Bridge on A614 to power operation.—See 2 Nov. issue.

21 Nov.—Ministry of Transport. Supply of steel lighting columns, traffic bollards and subway lighting and for cabling and installation work along Heads of the Valleys Rd (section 1—Brynmawr to Abergavenny.—See 2 Nov. issue.

22 Nov.—Godstone R.D.C. Installation of two 5 in. dia. submersible pumps/10 h.p. motors and 200 yd asbestos-cement rising main.—See 2 Nov. issue.

22 Nov.—Tyrone C.C. Supply and installation of service lift in Omagh County Secondary Intermediate School. Details from consulting engineers, McCandless and Barton, 6 Murray St, Belfast 1. Deposit £2 2s.

22 Nov.—Worsley U.D.C. Electrical work on: (a) Peel estate, Little Hulton (133 dwellings) and (b) Peel La, Wharton estate (32 dwellings). Engineer and Surveyor, L. T. Broome, Town Hall, Walkden.

23 Nov.—Down C.C. Electrical installation in Bangor Girls (new) Grammar School.—See 2 Nov. issue.

23 Nov.—Haughley P.C. Supply and erection of ten 25 ft concrete columns and 140 W sodium lighting.—See 9 Nov. issue.

24 Nov.—Hereford C.C. Electrical installations in 74 houses No. 6 site and 72 houses No. 7 site, Newton Farm.—Advertised 26 Oct. issue.

24 Nov.—Longbenton U.D.C. Supply and erection of 164 concrete post-top lantern filament lighting units.—See 9 Nov. issue.

24 Nov.—Manchester C.C. Supply of: 64 G.E.C. 25569B top entry lanterns; 93 chokes for 80 W h.p.m.v. lighting; 93 capacitors and 93 Sangamo Weston time-switches, type S.251. City Surveyor, Town Hall.

24 Nov.—Swansea C.B.C. Electrical installation in Hall of Residence, Swansea Training College. Applications to Borough Architect, The Guildhall, Swansea, by above date, giving details of similar work. Deposit £2.

27 Nov.—Billingham U.D.C. (Contract 1.) Supply of 104 concrete columns; (2) supply of 115 140 W sodium lanterns; (3) erection of columns/lanterns. Engineer and Surveyor, Council Offices, Haverton Hill. Deposit £1 1s each contract.

27 Nov.—Kirkcaldy B.C. Supply and installation of 400 cookers and 200 washboilers.—See 9 Nov. issue.

27 Nov.—Linlithgow B.C. Erection of 37 Class "B" steel columns and supply/erection of lanterns/lamps/gear.—See 9 Nov. issue.

27 Nov.—Strabane. Electrical installation in new office building for Ministry of Finance. Room 103, Law Courts Bldg, Belfast 1.

27 Nov.—Worksop B.C. Scheme involving 217 60 W sodium lighting on 15 ft concrete columns: (1) Supply of lanterns/lamps/gear; (2) removal of existing lighting and supply of columns together with wiring and fitting of equipment; (3) whole of work.—Advertised 2 Nov. issue.

28 Nov.—Dartford B.C. 15 15 ft steel columns and mercury lamps/lanterns on Temple Hill (Site 2c).—See 2 Nov. issue.

28 Nov.—Dartford B.C. 26 25 ft reinforced concrete columns and 400 W MBF/U lamps/lanterns along Watling St.—See 2 Nov. issue.

30 Nov.—Cardiff C.C. Electrical installation, on fixed-price basis, in proposed Fairwater Primary School, Pentrebane Rd.—See 9 Nov. issue.

2 Dec.—Barrhead B.C. Rewiring of 384 houses. Burgh Surveyor's Office, Municipal Bldgs, Bank St. N.I.C. firms only.

2 Dec.—Kilkenny C.C. One 1,000 g.p.h. submersible pump.—See 26 Oct. issue.

4 Dec.—Kincardine C.C. Electrical work in Glenbervie Primary School alterations and additions. County Architect and Planning Officer, Westfield Hse, Arduthie Rd, Stonehaven.

4 Dec.—Petersfield R.D.C. Supply and erection of Group "A" lighting: (1) 36 columns/one bracket with 140 W sodium lanterns/gear and wiring along London Rd, Liphook; (2) 36 columns with 140 W sodium lighting along London and Portsmouth roads, Horndean.—See 9 Nov. issue.

5 Dec.—Leeds C.C. Supply and erection of 30 g.p.m. at 165 ft head booster pumping plant, complete with switchgear, motors, time controls, etc., at Carlton Rise.—See 9 Nov. issue.

5 Dec.—Peterborough R.D.C. Supply of mobile alternator unit. Surveyor: M. R. Gibbs, 51 Priestgate.

6 Dec.—Hoylake U.D.C. Supply of 1,700 solar dial time-switches for street lighting. Engineer and Surveyor, 8 Riversdale Rd, West Kirby, Wirral.—Advertised in this issue.

7 Dec.—Dundee Harbour Trust. Supply and erection of three level luffing travelling cranes of the portal type.—See 9 Nov. issue.

9 Dec.—Seaton Valley U.D.C. Electrical installations in 32 houses at Seghill. Surveyor, T. W. Burgess, Council Offices, Seaton Delaval

13 Dec.—Keynsham U.D.C. Provision and installation of two 180 g.p.m. sewage pumps with motors for Norman Rd housing estate. Engineer and Surveyor, Council Offices. Deposit £2 2s.

18 Dec.—E.B. for N.I. Specification 1642. Lighting and heating associated with No. 4 boiler and turbo-generator at Coolkeeragh.—See 2 Nov. issue.

18 Dec.—Southampton C.B.C. Electrical installation in College of Technology.—Advertised 2 Nov. issue.

18 Dec.—Tonbridge U.D.C. Supply and erection of sewage pumps: two 300 g.p.m. at 28 ft head; two of 450 g.p.m. and two of 900 g.p.m. at 42 ft heads. Details from consulting engineers: John Taylor and Sons, Artillery Hse, Artillery Row, S.W.1. Deposit £5, made payable to U.D.C.

No date stated—Ross and Cromarty C.C. (b) Electrical work in Arthurville Hse, Tain. Applications to consulting engineers: Ian Hunter and Ptnrs., 46 Palmerston Pl, Edinburgh 12.

No date stated—Western Counties Hospitals. Applications for inclusion in select list for electrical work to Group Secretary, Royal Western Counties Hospital, Starcross, near Exeter.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 112 queries answered this week

"Elizabethan Dynamatic" washing machines—spares for? L.W.R.—Elizabethan Engineering Co. Ltd., Stansted Rd, Bishop's Stortford, Herts, have a few spare parts available.

"Bunting" yacht type fires—makers of? E.E.B.—Bunting, McConnell and Co. Ltd., Prospect Hill, Kidderminster, Worcs.

"Flamenco" heaters—makers of? T.E.—The makers, Midland Electric Mnfg. Co. Ltd., Reddings La, Tyseley, Birmingham 11, have now discontinued their entire range of domestic heating appliances.

"Radium" lamps—agents for? L.E.—Homeshade Co. Ltd., 99 Baker St, W.1.

"Pulsafe" safety eye guards—makers of? E.E.—Safety Products Ltd., Holmethorpe Ave, Redhill, Surrey.

"Surran" bed warmers—address for? E.E.W.—Singleton Bros. (Electronics) Ltd., 53 Victoria St, S.W.1.

"Viscount" vacuum cleaners—address for spares? M.E.B.—Bylock Electric Ltd., Cartersfield Rd, Waltham Abbey, Essex.

"Lectross" towel rails—spare elements for? G.B.—Electronic Precision Equipment Ltd., 46 Windmill Hill, Ruislip, Middx.

ANSWER WANTED

"Trident" washing machines—agents for? M.B.—

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

24 Nov.—India. Two 25 MVA synchronous condensers and gear for Rourkela substation. Director-General of Supplies and Disposals, Shahjahan Rd, New Delhi. B.o.T. (ESB/34989/61).*

24 Nov.—Iraq. Four 75 kW and four 100 kW diesel-alternator sets for Gurmat Beni Sa'eed, Beji, Guware and Qadsiyah. Ministry of Municipalities, Directorate-General of Planning and Design, Baghdad. B.o.T. (ESB/34967/61).*

28 Nov.—S.W. Africa. 22 ½-¼ kW generating sets; 25 1·9 kVA diesel generators. Secretary, S.W.A. Administration, P.O. Box 27, Windhoek. B.o.T. (ESB/34100 and 34301/61).*

29 Nov.—Australia. 12·7 kV reclosing c.b's and aluminium alloy conductors for Mackay Regional Electricity Board. S.E.C. of Queensland, 447 Gregory Terr, Brisbane. B.o.T. (ESB/34934 and 5/61).*

30 Nov.—Australia. Four 1·5 MVA and four 3 MVA three-ph. 33/11 kV transformers. Chief Engineer, Southern E.A. of Queensland, Boundary St, Brisbane. B.o.T. (ESB/34998/61).*

30 Nov.—Colombia. Two diesel generating sets for Puerto Tejada (Cauca) and Mompos (Bolivar). Instituto Nacional de Fomento Municipal, Departamenta Comercial, Bogotá. B.o.T. (ESB/34633/61).*

30 Nov.—Greece. 77,000 lamps (various types). Ministry of Trade, Direccion "B" State Procurements, 50 Socratous St, Athens. B.o.T. (ESB/34368/61).*

5 Dec.—Ceylon. Cable p.i.l.c. armoured from 0·0225 sq in. two-core to 0·3 sq in. four-core in 1·1 and 11 kV grades for Dept. of Government Electrical Undertakings. Details from Crown Agents, 4 Millbank, S.W.1, reference Q/EEI/Ceylon Electrical Stores/507.

9 Dec.—Sudan. 16 63 kVAr capacitor units, contactors and relays. Assistant General Manager (Supplies), Sudan Gezira Board, Barakat. B.o.T. (ESB/34346/61).*

11 Dec.—Australia. Circular scale switchboard instruments (11 items). Secretary, S.E.C. of Victoria, 22-23 William St, Melbourne. B.o.T. (ESB/34335/61).*

3 Jan.—India. Requirements of Heavy Electricals (India) Ltd.: (1) Grinding machines (various); reamer hob and cutter sharpening machine; vertical hydraulic press for commutators, etc. Tender HE/BPL/GT/MT/21, fee 15s. (2) presses (various); shears; universal plate bending and folding machines, etc. Tender HE/BPL/GT/MT/22, fee £1 10s. Heavy Electricals (India) Ltd., Crown Hse, Aldwych, W.C.2.

8 Jan.—Australia. Three 330 kV, 100 MVA s.ph. auto transformers. Manager and Secretary, E.C. of N.S.W., G.P.O. Box 5257, Sydney. B.o.T. (ESB/34071/61).*

17 Jan.—India. Requirements of Heavy Electricals (India) Ltd. (3) Welding and heating equipment. Tender HE/BPL/GT/MFG/11, fee 7s 6d. (4) Baking oven, dust extraction plant, vacuum dryer, etc. Tender HE/BPL/GT/MFG/12, fee 7s 6d. Heavy Electricals (India) Ltd., Crown Hse, Aldwych, W.C.2.

24 Jan.—Iraq. Transformer substations with new cable network at Al-Habania Camp. Directorate of Military Work, Baghdad. B.o.T. (ESB/34019/61).*

13 Feb.—New Zealand. 16 kV metalclad air-blast switchgear for Benmore Power Station (six items). Secretary, Tenders Committee, Electricity Department, Wellington. B.o.T. (ESB/34089/61).*

13 Feb.—New Zealand. Busbars, isolators and generator/transformer connections. Secretary, Tenders Committee, Electricity Dept., Wellington. B.o.T. (ESB/34093/61).*

CONTRACTS PLACED

Beddington and Wallington B.C. Rewiring of 112 dwellings, Richmond Rd, Wandle Rd and Millars Orchard estate, M. and B. Electrical Ltd., £3,830. Recommended.

C.E.G.B. (S.E. Region). Contracts placed during October amounted to £511,056 and include: Acton La, two 22/3·3 kV 3 MVA transformers, Brush Elec. Eng.; Acton La, two-ton goods lift, G. K. Jensen; Brighton, pipework, Aiton and Co. Ltd.; Cockfosters, research laboratory, W. and C. French Ltd.; Bengeworth Rd, sitework, J. Mowlem and Co.; East Ham, 66 kV and 11 kV cabling, Pirelli General Ltd.; Lombard Rd, 66 kV and 11 kV cabling, Pirelli General Ltd.; Sydenham, two 132/33 kV 45 MVA transformers, Hackbridge and Hewittic Elec. Co. Ltd.; Sydenham, 132 kV switchgear, A.E.I. Ltd.; Addington, 132 kV switchgear, A. Reyrolle and Co.; Betteshanger, two 132/33 kV 60 MVA transformers, Yorkshire Elec. Co.; Chessington, 33 kV cabling, Johnson and Phillips Ltd.; Purley, civil works, M. J. Gleeson Ltd.; Ruckinge and Ashford, oil handling plant, Streamline Filters Ltd.; Wimbledon and Northfleet, intertripping equipment, Automatic Telephone and Elec. Co. Ltd.

Dagenham B.C. Rewiring of Central Park estate dwellings, Evans and Shea Ltd., £16,135. Recommended.

Durham C.C. Rewiring of Billingham R.C. Aided School, Cox-Walkers Ltd., £1,941; electrical work in Eppleton Colliery Modern School additions, North of England Engineering and Electrical Co., £2,110; electrical installation in central repair depot, Cox-Walkers Ltd., £591. Recommended.

Hayes and Harlington U.D.C. Supply of Group "B" steel columns, Abacus Municipal Ltd.

Heston and Isleworth B.C. 214 Group "A" 400 W lanterns, Atlas Lighting Ltd., £15 6s 3d each: 216 Group "A" 250 W lanterns, Revo Electric Co., £8 17s 6d each: 430 Group "A" steel columns, Stewarts and Lloyds Ltd., £23 14s each. Recommended.

L.C.C. Lift installation, County Hall, south block extension, J. and E. Hall Ltd., £9,641. Electrical installations: Brandon estate, Southwark, Electric Contracts (London) Ltd., £2,837; Ethelburga St site, Battersea North, Holliday Electrical Ltd., £4,144; St. Helier estate, Surrey, F. J. Baynes and Co., £4,036; Watling estate, Hendon, F. J. Baynes and Co., £16,073.

Luton B.C. Rewiring of 26 Cannon La houses, J. and J. Burtenshaw and Ptnrs., £871.

Manchester C.C. Electrical installation in central library alterations, Electrical Contractors (Manchester) Ltd.: service lift installation, Ducie Technical School, J. and E. Hall Ltd.: lift installations at St. John's College of Further Education, Otis Elevator Co.: electrical installation in Openshaw College of Further Education, Sadler and Kinsey Ltd. Recommended.

Newcastle Hospital Board. Electrical work in: North Riding Infirmary, Doves (Darlington) Ltd., £1,441; Board H.O., J. Scott and Co. (Electrical Engineers) Ltd., £6,999 12s 6d; Hartlepools Hospital, Haigh and Ringrose Ltd., £1,800 7s 6d; Bishop Auckland General Hospital, Doves (Darlington) Ltd., £8,096 12s; West Cumberland Hospital, G. Bowman Ltd., £164,873; Cumberland Infirmary, J. Scott and Co. (Electrical Engineers) Ltd., £4,257.

Whickham (Durham) U.D.C. Provision of street lighting at Swalwell Bank, Dunston Bank, and King George Ave, Dunston, B. L. Oliver. Recommended.

Woolwich B.C. Replacement lighting for Shooters Hill, Eleco, £1,040. Recommended.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Comtex. 821,465. Class 7. Motors, etc. Comtex Ltd., 43 Portland Pl, W.1.

County. 821,591. Class 9. Batteries, etc. City Tyre Service (Hereford) Ltd., 6 Kyrle St, Hereford.

Ektron. 804,280. Class 9. Radiation-sensitive elements for measuring light, temperature and humidity, etc. Kodak Ltd., Kodak Hse, Kingsway, W.C.2.

Flowline. 820,286. Class 9. Dictating machines and apparatus for the remote control thereof, etc. Pullman Business Machines Ltd., Pullman Hse, 29-37 Goswell Rd, E.C.1.

Impala. 822,866. Class 7. Washing, drying machines, etc. Gay-Day (Domestics) Ltd., 47 Chorlton St, Manchester 1.

Koswa. 818,277. Class 9. Scientific and electrical apparatus and instruments, thermostats, time switches, etc. Koswa Ltd., Anstey Mill La Wks, Alton, Hants.

Newman Seal. B818,744. Class 7. Motors, etc. Newman Industries Ltd., Yale, Bristol.

Onan. 823,291. Class 7. Generating plant for providing a.c. and d.c. current, battery charging generating sets, etc. 823,292. Class 9. Control apparatus and panels, etc. G.M. Power Plant Co. Ltd., 1-3 Richmond Rd, Ipswich, Suffolk.

O-b't. 808,679. Class 11. Domestic and industrial lighting fittings. Walsall Conduits Ltd., Excelsior Wks, Dial La, Hill Top, West Bromwich, Staffs.

Paratherm. 819,830. Class 9. Scientific and electrical apparatus and instruments, etc. Firma Kontaktwerk Enzberging, Alfred Odenwald, Hauffstrasse 8, Enzberg, Wurttemberg, Germany.

Paristor. 823,186. Class 9. Apparatus for calculating electrical resistance and capacitance, etc. Paristor Ltd., 96 Park La, Croydon, Surrey.

Plesmet. 823,754. Class 9. Resistors, etc. The Plessey Co. Ltd., 56 Vicarage La, Ilford, Essex.

Regor. 819,698. Class 11. Lighting fittings and appliances, etc. H. B. Rogers Ltd., Sandell St, Waterloo Rd, S.E.1.

Rotostat. 822,961. Class 7. Motors, etc. Ancienne Manufacture D'Horlogerie Patek, Phillipe et Co., Grande Quai 22 and Rue du Rhone 41, Geneva, Switzerland.

Sabre. 819,188. Class 9. Scientific and electrical apparatus and instruments, etc. Wilkinson Sword Ltd., 16 Pall Mall, S.W.1.

Viscomat. 820,961. Class 11. Devices for pre-heating oil fed to oil burners in furnaces, etc. Duncan Low Ltd., 57-61 Trossachs St, Glasgow N.W.

TRADE NOTES

Transfer. The "Dustmaster" built-in vacuum cleaning machine, formerly made by Sir George Godfrey and Partners (Industrial) Ltd., is now being made and marketed under the name of "Vacuummaster," by the Built-In Vacuum Cleaner Co., 93 Black Lion Lane, W.6.

Distributors. Elgar Machine Tool Co. Ltd., 172-178 Victoria Rd, W.3, have been appointed exclusive distributors in the U.K. for internal keyseating machines made by Maillefer, S.A., of Lausanne, Switzerland, and for plastics and rubber processing plant made by Joh. Kleinewefers Sohne, of Krefeld, Germany.

Polyethylene dumping. Monsanto Chemicals Ltd. have joined with I.C.I. Ltd. in seeking legislation against the "dumping" of foreign-made polyethylene in Gt. Britain.

Peru Tariff. Peru has reduced the duty surcharge on electrical measuring instruments, telephone switchboards and parts, and radio valves from 200% to 50%.

BUSINESS PROSPECTS

Aberdeen. C.C. propose 184 houses and four multi-storey blocks of flats, Hazlehead; City Architect, Broad St.

Aycliffe. Factory additions planned for Bridgewater Machine Co.; contractors: E. Lawson Ltd., 27 Victoria Rd, Darlington. D.C., Churchill Hse, Newton Aycliffe, propose 359 dwellings.

Aylesbury. Y. J. Lovell (Bucks) Ltd., 4 Endsleigh Gdns, W.C.1, awarded contract for five-storey extensions for Nestle Co. Ltd.

Ayr. Proposed: hotel/offices/30 shops/supermarket, Alloway St/Dalblair Rd, for Murrayfield D.C., Cornhill Hse, West George St, Glasgow C.2; cost: £400,000.

Banffshire. Extensions to cover 10,000 sq ft planned at A.E.I. Lamp and Lighting Co. Ltd. works, Buckie; work will be carried out by Industrial Estate Management Corpn. for Scotland, Glasgow.

Barton-on-Humber. U.D.C. propose conversion of Baysgarth Hse to new civic centre; Surveyor.

Batley B.C. Tender: 14 shops with flats over, Upper Commercial St; Engineer.

Birmingham. Regional Hospital Board propose £10,000 lift, Highfield Hospital; service lift for central kitchen, Highcroft Hospital, £2,500; upgrading of electrical services and two lifts, Little Bromwich Hospital, £30,350.

Blackpool. Thos. M. Nutbrown Ltd., Walker St, propose industrial development, Preston New Rd and Clifton Rd. Lewis's Ltd., Ranelagh St, Liverpool 1, propose shops and departmental store on site of Palace Theatre.

Bognor Regis. Proposed: three further factories, South Bersted industrial estate, by Ronald Lyon (Estates) Ltd., Auckland Hse, New Zealand Ave, Walton-on-Thames.

Bristol. C.C. propose £40 million building programme in next five years, including tower blocks of flats; Chief Assistant Architect. Offices to cost £912,000 proposed at Filton for Bristol Siddeley Engines Ltd.; contractors: Higgs and Hill Ltd., Crown Wks, South Lambeth Rd, S.W.8.

Cardiff. Proposed: £350,000 new west wing of National Museum of Wales; architects: T. Alwyn Lloyd and Gordon, 6 Cathedral Rd.

Chelmsford. Proposed factory at Widford industrial estate for Maywick Appliances Ltd., High St, Wickford. New building for chemical storage proposed by Marconi's Wireless Telegraph Co. Ltd., New St (c/o N.D. and P. Dept.), canteen, etc., for Marconi International Marine Communication Co. Ltd., New St; architects: Taylor, Son and Bracken, 78 London Rd.

Chester-le-Street. R.D.C. propose 94 houses, Barley Mow; 22 Edmondsley; architect: F. Bowman, Estate Office, Birtley.

Chichester C.C. Tender: 70 dwellings for old people. N. W. Parklands, City Engineer.

Coventry. Birmingham Regional Hospital Board propose reorganisation of electrical distribution system (stage 1), Gulson Hospital, £6,000.

Croydon. £50,000 factory and offices proposed for Philips Electric Ltd., Beddington Farm Rd; contractors: W. J. Sims, Sons and Cooke Ltd., Beddington La.

Dagenham. Planned: extensions to factory, Hainault estate, for Megam Units Ltd.

Darlington. Four-storey industrial and storage building planned, Priestgate, for A. W. Snaith and Son Ltd., Darlington; architect: H. B. Richardson, 3 Skinnergate.

Derby. Courtaulds Ltd., Foleshill Rd, Coventry, propose laboratories, offices and factory extensions, Holme La, Spondon. Sheffield Hospital Board, Old Fulwood Rd, Sheffield, propose operating theatre improvements, Derbyshire Children's Hospital.

Doncaster. B.C. propose 50 bungalows for old people on local housing estates; Engineer.

Dorking. S.W. Metropolitan Regional Hospital Board, Eastbourne Terr, W.2, plan to rebuild General Hospital on existing site.

Durham. Proposed: admin. offices, Spennymoor; County Architect, South St. C.C. award £243,718 contract for Bishop Auckland Woodhouse Close Secondary School to Bell and Ridley Ltd, North Rd.

East Kilbride. New Scottish depot proposed for Lansing Bagnall Ltd., Basingstoke.

Edinburgh. Scottish Oils and Shell-Mex Ltd. propose 11-storey office block, Lauriston St; architects: Stanley Poole and Assoc., 60 Castle St.

Erith. Park Investments Ltd. plan to rebuild 25 acres of centre of Erith at cost of £6 million; architects: R. Seifert and Ptnrs., 34 Red Lion Sq, W.C.1.

Glasgow. Proposed by Mactaggart and Mickel Ltd., 107 West Regent St, C.2, development, Lennoxtown, Campsie Hills; 2,000 houses planned with shops in small town.

Glenrothes. D.C. propose 28 shops, seven offices and five flats. Secretary, Glenrothes, Fife.

Harrow. Middx C.C. propose old people's home to cost £76,500, Vernon Drive; architect: Guildhall, Westminster.

Hastings. Guy Morgan and Ptnrs., 20 Grosvenor Pl, S.W.1, architects for industrial premises at Eversfield estate for Freevale Properties Ltd., Regent St, W.1.

Heston and Isleworth. B. N. White-Spunner Ltd., 640 London Rd, Isleworth, propose redevelopment of 632-52 London Rd in seven-storey office block, with showrooms, workshops and petrol service station.

Kendal. Proposed: new factory, Mint Bridge, for Glaxo Laboratories Ltd.; contractors: Taylor Woodrow Construction Ltd., Southall, Middx.

Kirkcaldy B.C. Tender: 85 houses, Nicol St; Engineer.

Lanchester. New wing is planned, Ushaw College; architects: D. Brown, 10 Lampton Rd, Jesmond, Newcastle.

Leeds. C.C. propose aged person's home, Kirkstall, estimated cost £90,000, and aged person's home, Greenside, Lower Wortley, £90,000.

Liverpool. Gaumont British Cinemas Ltd., 38 South St, W.1, plan to convert Beresford Cinema, Park Rd, into offices and supermarket. Littlewoods Mail Order Stores Ltd. propose headquarters building, Old Hall St.

London. Geo. Wimpey and Co. Ltd., Hammersmith Gro, W.6, to redevelop 44-54 St. John's Wood Rd, 32-36 Lodge Rd and 11-21 Fairlop Pl with building of ground floor and ten upper floors containing 83 flats and terrace of six houses. City Centre Properties (Marylebone) Ltd., 32 Victoria St, S.W.1, in association with B.T.C., propose £5 million scheme for redevelopment of about ten acres, Marylebone Station, N.W.1. Proposed: £1 million redevelopment on island site, Euston Rd area; architects: Devereux and Davies, 3 Gower St, W.C.1.

Maidenhead (Berks) B.C. Tender: 58 dwellings, Cox Green estate. Surveyor.

Manchester. B.B.C., Portland Pl, W.1, propose new North Regional H.Q. Whitworth Street Estates (Manchester) Ltd. plan 15-storey office block with basement, Major St/Sackville St.

Marple. Proposed: a new factory for Kay Bros. Ltd., Reddish, Heaton Moor, Ches.

Middlesbrough. B.C. award contract for 126 dwellings, Easterside, to Emco Ltd., Kings Rd, North Ormesby. Tender: 59 dwellings, Dunstable Rd; Borough Engineer. Proposed: Prissick Hse No. 5 Secondary School; Education Architect.

Midlands. Birmingham Regional Hospital Board, Edgbaston, to accept tenders as follows: out-patients' dept., Corbett Hospital, Stourbridge—J. Hickman (Brierley Hill) Ltd., Brierley Hill, £349,786; reorganisation of engineering services, St. Matthew's Hospital, Lichfield—Richard Crittall and Co. Ltd., 42 Gooch St, Birmingham 5, £114,000; staff quarters, Dudley Rd Hospital, Birmingham—W. J. Whittall and Son Ltd., 132 Lancaster St, Birmingham 4, £106,686.

Midlothian C.C. Tender: 156 dwellings, Newbattle Community. Co. Architect, Palmerston Pl, Edinburgh.

Mochdre. Factory, Glan-y-Wern Rd, proposed by Smith's Potato Crisps Ltd., Great West Rd, Brentford.

Motherwell. Proposed: £200,000 scheme, Merry St, for 36-room hotel/supermarket/shops/offices/bowling centre; promoters: Grampian Properties Ltd.

Newcastle. C. S. Errington, 46 Grainger St West, architect for Hindhaughs Ltd. offices, factory, warehouse, Fisher St. C.C. propose 9 shops, library, post office and 72 flats, Fawdon Park Rd; City Architect, Cloth Market. Barclays Bank Ltd., 54 Lombard St, E.C.3, propose £130,000 bank/offices building, Northumberland St.

N. Ireland. A new terminal building and apron to cost £720,000 proposed Aldergrove Aerodrome; architects: W. H. McAlister and Ptnrs., 6 Donegall Rd, Belfast.

Nottingham. Shops/flats, Goose Gate/Brightmoor St, proposed by T. S. Kaye and Sons Ltd., 29 George St, Hull.

Oldham C.B.C. Tender: 120 flats, Fitton Hill estate. Cameron and Middleton, 21 Mumps, quantity surveyors.

Potters Bar. Middx C.C. propose old people's home in grounds of Stapleton Hse; cost: £105,940.

Penybont R.D.C. Tender: 68 traditional dwellings, Derilwyn Hill, and Tondu, and Llangynwyd.

Rotherham. Proposed: laboratory and office block at Ginhouse La, for J. Wilkinson and Son Ltd., Attercliffe, Sheffield 9. Extensions/alterations, Eastwood Trdg. estate, for Backer Electric Ltd.

Seaton Valley U.D.C. Tender: all trades including supply of electrical goods for 32 houses, Seghill. Surveyor.

Sheerness. Proposed by Sheerness Harbour Co., on behalf of Raine and Co., new steel works, Well Marsh area.

Sheffield. Planned by Covenant Securities Ltd., 130 Mount St, W.1, tenement factory building, Trafalgar and Rockingham streets.

Shrewsbury. Birmingham Regional Hospital Board, propose power main distribution to wards, Copthorne Hospital, £5,000; and electrical distribution, Cross Houses Hospital, £2,000.

South Wales. W. R. Grace and Co., U.S. chemical mnfrs., propose first plant in Britain for manufacture of polyisbutylene; site: Baglan Bay; designers and contractors: Parsons Power-gas, 15 Portland Pl, W.1.

Spalding. Welland River Board propose new offices, Marsh Rd; architects: W. E. Norman Webseter and Son, Station St.

Sunderland. Newcastle Hospital Board propose two operating theatres, Ryhope General Hospital; consulting engineers: R. W. Gregory and Ptnrs., Pilgrim Hse, Pilgrim St, Newcastle. B.C. Tender: 156 dwellings, Parade area; 176 dwellings, Coronation St; Borough Architect.

Sutton and Cheam. Heron Group, 21 Chiswell St, E.C.1, propose nine shops with two floors of offices over, a two-storey supermarket with cafeteria and a two-storey public house, London Rd.

Thurrock. U.D.C. propose £501,990 swimming pool/public hall, King George's Fields, Blackshots, Grays.

Twickenham. A. A. Thornton (Teddington) Ltd., 150 Hampton Rd, W. Hanworth, propose office block and covered fabrication shops, Millfield Wks, Millfield Rd.

Walton and Weybridge. U.D.C. propose £170,000 swimming pool. Consulting engineers, Ove Arup and Ptnrs., 13 Fitzroy St, W.1.

Ware. M.o.W. (Architect's Dept., Abell Hse, John Islip St, S.W.1) propose school for engineers, with a residential hostel and admin. buildings, Terlings estate, Gilston.

Watford. Proposed: £2 million scheme by H. O. Hills stores group for two tower blocks.

Yeovil. City and Town Buildings Ltd., 171 Shaftesbury Ave, W.C.2, plan redevelopment of eastern section of Middle St with shops/office-blocks/supermarket/department store.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Chiltern Electrics Ltd. Mr G. A. Wale, Walter Hse, 418-422 Strand, W.C.2, appointed liquidator at extraordinary general meeting on 13 Oct. for the purpose of voluntarily winding-up.

Ratcliff (Electric) Ltd. Meeting of creditors to be held at 93 Queen St, Sheffield 1, on 16 Nov., at 3 p.m.

Walter Instruments Ltd. Creditors to send details to liquidator: C. E. M. Emmerson, 28 King St, E.C.2, by 5 Dec.

Lowelectric Ltd. Winding-up order dated 30 Oct.

North London Wholesale Supplies Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 20 Nov. Persons intending to appear to notify J. E. Baring and Co., 22 Theobalds Rd, W.C.1, by 4 p.m., 17 Nov.

Jonmill Building Developments Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 20 Nov. Persons intending to appear to notify S. Tonkin and Co., 3 Berners St, W.1, by 4 p.m., 17 Nov.

Eden Electrical Co. Ltd. First meetings of creditors and contributories to be held at Room 401, Inveresk Hse, 346 Strand, W.C.2, on 16 Nov., at 11.30 a.m. and 12 noon, respectively.

G. and T. Electrics Ltd. Meetings of creditors and contributories to be held at Room 401, 346 Strand, W.C.2, on 21 Nov., at 2.30 and 3 p.m., respectively.

Rowyn Ltd. Meetings of creditors and contributories to be held at Room 401, 346 Strand, W.C.2, on 21 Nov., at 11.30 a.m. and 12 noon, respectively.

Voluntary Liquidation

Woodgrange Electric Ltd. 30 Woodgrange Rd, E.7, retailers of electrical goods.

The statement of affairs for this company, which was formed in Aug., 1959, showed liabilities of £9,084, including £4,121 due to trade and expense creditors and £4,963 to the Bank. There was also a contingent liability of £13,000 for hire purchase.

Creditors confirmed the voluntary liquidation with L. C. Curtis, 13 Wimpole St, W.1, as liquidator.

BANKRUPTCY ACTS

Receiving Orders

Leicester. S. C. Doubleday and K. W. Palmer, radio and television dealers and electrical contractors, formerly carrying on business as Doubleday and Partner at Brook St, Braunston. Receiving order dated 31 Oct.

Maidstone. D. C. Peacock, formerly carrying on business in partnership as Domestic Electric Services, at 67-69 King St. Receiving order dated 31 Oct.

First Meetings and Public Examinations

High Court of Justice. J. A. Inverarity, electrical contractor, formerly carrying on business as Collins and Ptnrs., at 43 Mason's Ave, Wealdstone, Harrow. First meeting: 12 noon, 21 Nov.; and public examination: 11 a.m., 24 Jan., both at Bankruptcy Bldgs, Carey St, W.C.2.

Canterbury. L. T. Simpson and P. B. Cannon, electrical dealers, formerly carrying on business as Hayden Sterling at 3a Lynton Parade, Edgar Rd, Cliftonville; 1a Harbour Bldgs, Whitstable; and 3 Minnis Bay Parade, Birchington. First meeting: 11 a.m., 17 Nov., at Official Receiver's Office, 35 Watlington, Canterbury; public examination: 10.35 a.m., 23 Jan., at Sessions Hse, Longport, Canterbury.

Application for Discharge

Stafford. L. G. A. Shaw, electrical contractor, formerly carrying on business with A. Owen as Owen and Shaw at Corner Shop, Cross Rds, Hixon. Order made on application for discharge: discharged as from 6 Nov.

Appointment of Trustees

Lincoln and Horncastle. D. H. Dray, appliance sales and service engineer, carrying on business at Racecourse Bungalow, Willingham Rd, Market Rasen. Mr L. F. McCulloch, 26 South St. Mary's Gate, Grimsby, appointed trustee as from 1 Nov.

Scarborough. C. Parker, refrigeration and electrical sales and service proprietor, formerly carrying on business at 4 Newlands Park Rd. Mr S. D. Moore, 4 Silver St, Hull, appointed trustee as from 31 Oct.

Cheltenham. D. A. Durston, electrical engineer, formerly carrying on business as E.M.U. Contracts at "Llo-cha" and at "Dever," New Inn La, Shurdington. Mr P. W. Hort, 28 Baldwin St, Bristol 1, appointed trustee as from 31 Oct.

Sheffield. B. L. V. Page, retailer, formerly carrying on business as Page Domestic Electrical Appliances at 77 Cleveland St, 33-34 Scot La and 17 St. Sepulchre Gate, Doncaster, and 7 North Way, Scarborough, and 7 London Rd, Grantham. Mr P. Cardwell, 93 Queen St, Sheffield 1, appointed trustee as from 25 Oct.

Intended Dividend

Carlisle. G. B. Barnes, radio and electrical engineer, carrying on business as A.B.C. Electrical Co. at 23 Front St, Brampton. Last day for receiving proofs for intended dividend: 22 Nov., by trustee: D. Atkinson, 14 Lowther St, Carlisle.

MEETINGS TO NOTE

THURSDAY, 16 NOV.

I.E.E. (Utilisation). "The Design and Performance of High- and Low-voltage Terminal Boxes," K. K. Schwarz. Savoy Pl, W.C.2. 5.30 p.m

SOCIETY OF INSTRUMENT TECHNOLOGY (Data Processing Section). "Digital Techniques for the Study of Sea Waves, Ship Motion and Similar Processes," D. E. Cartwright, M. J. Tucker and Miss D. B. Catton. Manson Hse, 26 Portland Pl, W.1. 6.30 p.m.

FRIDAY, 17 NOV.

I.E.E. (N.E. Graduates and Students). "The Transient Performance of the Synchronous Generator," M. W. Kennedy. Grey Hall, King's College, Newcastle upon Tyne. 6.30 p.m.

I.E.E. (N. Midlands). Annual dinner at Queen's Hotel, Leeds. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Scottish). "Development of a Precision Pressure Generator for Multiple Instrument Calibration," B. E. Adams. Scottish Building Centre, Sauchiehall St, Glasgow. 7.15 p.m.

INSTITUTE OF PHYSICS AND PHYSICAL SOCIETY (X-Ray Analysis Group). "Imperfections in Crystals." Institution of Mechanical Engineers, Birdcage Walk, S.W.1; and 18 Nov.

E.T.C.T.A. A.G.M. at Feathers Hotel, S.W.1. 6.30 p.m.

MONDAY, 20 NOV.

I.E.E. Discussion: "Electrical Accidents and Their Causes — Including the Legal Aspects." Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (E. Midlands Electronics and Control Group). "Some Recent Advances in Semiconductor Circuits," G. B. B. Chaplin. Joint meeting with the Bedfordshire Sub-Centre. Swan Hotel, Bedford. 7 p.m.

I.E.E. (Mersey and N. Wales). "Transistors," P. Godfrey. Town Hall, Chester. 6.30 p.m.

I.E.E. (N.E. Measurement and Electronics Group). "Simulation of Intelligence," Prof D. M. Mackay. Rutherford College of Technology, Northumberland Rd, Newcastle upon Tyne. 6.15 p.m.

I.E.E. (Western Supply Group). "The Manufacture, Properties and Use of Some of the New Insulation Materials for the Electrical Industry," K. Pollard. Demonstration Theatre, Electricity Hse, Colston Ave, Bristol. 5.15 p.m.

I.E.E. (London Graduates and Students). "History of Modern Television," A. D. G. Wheatley. Unit Cinema, 3 (Tels.) Trng. Bn., R.E.M.E., Arborfield, Berks. 7 p.m.

I.E.E. (N.W.). Discussion: "Exchange of Ideas on Laboratory Experiments." Electrical Engineering Laboratories, Manchester University. 6.15 p.m.

I.E.E. (Sheffield). "A General Theory of Depreciation of Engineering Plant," D. Rudd. Angel Hotel, Brigg. 7 p.m.

R.S.A. Cantor Lecture: "Exports and the Country's Economy," J. L. S. Steel. John Adam St, Adelphi, W.C.2. 6 p.m.

INSTITUTION OF MECHANICAL ENGINEERS (Ind. Admin. and Eng. Production Group). Discussion: "Mechanical Handling of Small Parts With Special Reference to Automatic Assembling Equipment." 1 Birdcage Walk, Westminster, S.W.1. 6 p.m.

I.E.S. (Bath and Bristol Centre). "Lighting For Photography," R. W. Unwin. Grand Hotel, Bristol.

I.E.S. (Leeds Centre). "Continental Lighting Practice," A. W. Gostt, British Lighting Council, 24 Aire St. 6.15 p.m.

INSTITUTE OF PHYSICS AND PHYSICAL SOCIETY (Manchester). "Neutron Diffraction," Dr G. E. Bacon. College of Science and Technology, Manchester. 7 p.m.

BIRMINGHAM ELECTRIC CLUB. "Electro-magnetic Pumping of Liquid Metals," J. A. S. Hilditch. Grand Hotel. 5.30 p.m.

INSTITUTION OF PRODUCTION ENGINEERS (Midlands). "Technique on Fine Boring," J. R. Judkins. Craven Arms Hotel, High St, Coventry. 7 p.m.

A.S.E.E. (Bristol and West). "Principles of Radio and Television Communication," R. E. Griffin. Grand Hotel, Bristol. 8 p.m.

A.S.E.E. (Mid-Essex). "The Aims and Objects of the Electrical Association for Women," Mrs S. T. Gunstone. White Hart Hotel, Tindal St, Chelmsford. 7.45 p.m.

A.S.E.E. (Sheffield). Ladies' Night at Dog and Partridge Hotel. 7.30 p.m.

TUESDAY, 21 NOV.

I.E.E. (Measurement and Control). Discussion: "The Precision Required in the Calibration of Industrial Instruments." Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (S. Scotland). Dinner-dance. Grosvenor Restaurant, Gordon St, Glasgow. 6 p.m.

I.E.E. (Southern Electronics and Control Group). "The Application of Electrical Phenomena at Liquid Helium Temperatures," R. F. Hayes. C.E.G.B. Offices, High St, Portsmouth. 6 p.m.

I.E.E. (Western). Faraday Lecture: "Expanding Horizons in Communications," D. A. Barron. Colston Hall, Bristol. 6.30 p.m.

I.E.E. (N. Midlands Utilisation Group). "A Survey of Street Lighting and Its Future," W. R. Stevens and H. M. Ferguson. Leeds County Conservative Club, South Parade, Leeds 1. 6.30 p.m.

I.E.E. (N.W. Measurement and Control Group). "Transistor Instruments in Rockets," G. C. Haigh. Engineers' Club, Albert Sq, Manchester 2. 6.15 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Cheltenham). "Automatic Railway Signalling," J. A. Heald. Belle Vue Hotel. 7.30 p.m.

I.E.S. (Liverpool Centre). "Official Lighting," R. G. Hopkinson and J. Longmore. Industrial Development Centre, Paradise St. 6 p.m.

I.E.S. (N. Lancs Group). "The New I.E.S. Code," W. Robinson. Demonstration Theatre, N.W.E.B., 19 Friargate, Preston. 6.30 p.m.

INSTITUTION OF CIVIL ENGINEERS. "The Main Building for the 7GeV Proton Syncrotron at Harwell," S. A. Rossiter and J. S. Brown. Gt. George St, S.W.1. 5.30 p.m.

INSTITUTION OF PRODUCTION ENGINEERS (S. Eastern). "Static Switching Applied to Machine Tool Control," W. G. Turner. Half-way Hse, Dunstable Rd, Luton. 7.30 p.m.

A.S.E.E. (Portsmouth and District). "Safety in the Utilisation of Electricity," S. J. Emerson. H.M.S. *Collingwood*, Fareham. 7.30 p.m

A.S.E.E. (W. Kent). "Electricity on the Dairy Farm," P. Wakeford. Rose and Crown Hotel, Tonbridge. 7.30 p.m.

WEDNESDAY, 22 NOV.

I.E.E. (Supply). "Electronic Analogue Computer Simulation of Multi-machine Power System Networks," A. S. Aldred: and "Analysis of Overall Stability of Multi-machine Power Systems," J. G. Miles. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (S. Midlands). "Experimental Investigation of Space," J. A. Ratcliffe. Midland Institute, Birmingham. 6.30 p.m.

I.E.E. (Southern). "Construction, Operation and Maintenance at 132 kV and 275 kV Overhead Grid Lines," J. A. Watefield and H. G. New. Abbey Hse, Winchester. 6.30 p.m.

I.E.E. (Cambridge Electronics and Measurement Group). "Recording of High-speed Phenomena," C. W. B. Grigson. Cambridge University Engineering Dept., Trumpington St. 6 p.m.

INSTITUTION OF MECHANICAL ENGINEERS. James Clayton Lecture: "Reflections on the Institution's Role in Engineering Education," Prof E. Giffen. 1 Birdcage Walk, Westminster, S.W.1. 6 p.m.

Meetings to Note—continued

BRITISH INSTITUTION OF RADIO ENGINEERS (Computer Group). "Adaptive Optimizing Control," London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 6 p.m.

NORFOLK ELECTRICAL CIRCLE. Annual dinner at Flixton Room, Norwich. 6.30 p.m.

THURSDAY, 23 NOV.

I.E.E. "The B.B.C. Television Centre and Its Technical Facilities," F. C. McLean, H. W. Baker and C. H. Colborn. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Educational Discussion Circle). Discussion: "The 57 Effects of an Electrical Current." Savoy Pl, W.C.2. 6 p.m.

I.E.E. (Western). Faraday Lecture: "Expanding Horizons in Communications," D. A. Barron. Sophia Gdns Pavilion, Cardiff. 6.45 p.m.

I.E.E. (N.E. Graduates and Students). "The Silicon Controlled Rectifier, a New Tool for the Power Engineer," R. Dunn. Sunderland Technical College. 6.30 p.m.

MINISTRY OF WORKS (St. Albans). "Combination of Natural and Artificial Lighting in Buildings," A. D. Charters. Hertfordshire College of Building, Hatfield Rd. 7.15 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Chester). "Transistors Applied to Modern Instrumentation," J. E. Fielden. Stanley Palace, Watergate St. 7 p.m.

A.S.E.E. (N. Ireland). "An Informal Talk," D. S. McIlhagger. Central Hall, Rosemary St, Belfast.

A.S.E.E. (Nottingham). "Plastics in the Electrical Industry," A. J. Moulam. People's College of Further Education, Castle Rd. 7.30 p.m.

A.S.E.E. (S. London). "The National Inspection Council for Electrical Installation Contracting," E. J. Sutton. Greyhound Hotel, Croydon. 8 p.m.

A.S.E.E. (Southampton). "Electric Water Heating." Polygon Hotel. 8 p.m.

FRIDAY, 24 NOV.

I.E.E. (N. Staffs). Annual dance with Graduate and Student Section. Crown Hotel, Stone, Staffs. 8.30 p.m.

I.E.E. (S. Midlands). Discussion: "A Materials Course for Electrical Engineers." College of Technology, Gosta Green. 6.15 p.m.

I.E.S. (Cardiff). Dinner-dance. St. Mellons County Club.

I.E.S. (Glasgow Centre). Luncheon meeting. Grand Hotel, Charing Cross. 12.30 p.m.

A.S.E.E. (Coventry and District). "Industrial Motor Control Gear," B. Bardell. Conservative Rooms, 16 Queens Rd. 8 p.m.

A.S.E.E. (Halifax). Annual Dinner at Old Cock Hotel.

A.S.E.E. (Oxford and Districts). "Power Factor Correction," T. A. Williams. Technical College, Walton Rd, Aylesbury. 7.30 p.m.

A.S.E.E. (Stoke and Crewe). "Temperature Control," L. Clarke. Grand Hotel, Hanley. 7.30 p.m.

MONDAY, 27 NOV.

I.E.E. (N.E.). "The Place of Formal Study in the Post-Graduate Training of an Electrical Engineer," N. N. Hancock and P. L. Taylor. Neville Hall, Westgate Rd, Newcastle upon Tyne. 6.15 p.m.

I.E.E. (N. Staffs). "Electric Traction," J. A. Broughall. Mechanics' Institute, Crewe. 7 p.m.

I.E.E. (Western Utilisation Group). "Silicone Electrical Insulation," J. H. Davis. South Wales Institute of Engineers, Cardiff. 6 p.m.

I.E.E. (S. Midlands Electronics and Measurement Group). Third Hunter Memorial Lecture: "The Application of Electronics to the Electricity Supply Industry," J. S. Forrest. James Watt Memorial Institute, Birmingham. 6 p.m.

R.S.A. Cantor Lecture: "Production for Export," R. M. Geddes. John Adam St, Adelphi, W.C.2. 6 p.m.

MINISTRY OF WORKS. "Essentials of Good Concreting," E. E. H. Bate. College of Further Education, High Wycombe. 7.15 p.m.

I.E.S. (Birmingham Centre). "Lighting of Large Office Buildings," J. H. D. Madin. Chamber of Commerce, 75 Harborne Rd, Edgbaston. 6.30 p.m.

INSTITUTION OF PLANT ENGINEERS (W. and E. Yorks). "Basic Electronics in Industry and Commerce." R. H. Garner. Houldsworth School of Applied Science, Leeds University. 7.30 p.m.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Bramlay Ltd., 13 Well Court, Bow La, E.C.4. Electrical and general engineers, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: L. R. Battell and W. J. Wildman.

Bulpitts Lampshades Ltd., 178 Walsall Rd, Darlaston, Staffs. Nom. cap.: £1,000. Permanent dirs.: John B. Makin and Alan M. Bulpitt.

Continental Lighting (Wholesale) Ltd., 376 Anlaby Rd, Hull. Nom. cap.: £500. Dirs.: Richard N. Morcom and Evelyn S. Morcom.

Diaz Electric (Dunstable) Ltd., 201 Gt. Portland St, W.1. Nom. cap.: £1,000. Dirs.: Joseph Diaz and John F. Venner.

Fellows and Fullwood Ltd., 21 Queen's Cross, Dudley, Worcs. Electrical wholesale suppliers, etc. Nom. cap.: £5,000. Permanent dirs.: Wm. V. Fellows and Albert Fullwood.

Harplin Ltd. Other details similar to Bramlay Ltd.

W. Hutchison and Sons Ltd., 38 Millicent St, Cardiff. To take over the business of an electrical engineer carried on at Cardiff by W. E. Hutchison, etc. Nom. cap.: £1,000. Dirs.: Wm. E. Hutchison, William J. P. Hutchison and William A. Hutchison.

Instrument Drives Ltd., 68 Lisbon Ave, Twickenham, Middx. Electrical engineers, etc. Nom. cap.: £500. Dirs.: Kenneth Tasker and Jack E. F. Tulett.

Leyford (Electrical) Ltd., 8 Penerley Rd, S.E.6. Electrical engineers, etc. Nom. cap.: £100. Dirs.: Edward Whitelaw and Fredk. H. G. Osborn.

Mangla Constructors Ltd., 66 Warwick Sq, S.W.1. To tender for and construct a dam on the Jhelum River, etc. Nom. cap.: £100. Dirs.: not named. Subs.: John W. Scott and John D. Campbell.

Gordon B. Moore (Electrical) Ltd., 202 Mansfield Rd, Nottingham. Nom. cap.: £2,500. Dirs.: Graham Moore, Albert V. Sayers and Gordon H. Jones.

Mores Electrical (Agricultural) Ltd., Field Farm, Burghfield, Reading, Berks. Nom. cap.: £1,000. Dir.: Alan J. More.

Petersfield Electrical Services Ltd., 10 South Pallant, Chichester. Nom. cap.: £1,000. Dirs.: Bernard J. Bull and Willards Electrical Services Ltd.

P.W. Electrical Ltd. Nom. cap.: £1,000. Electrical engineers, etc. Dirs.: Cyril A. Whittington, 10 Forge Hill, Oughtibridge, Sheffield; and Dennis W. Porter.

Rent-A-Phone Ltd., 8 Hale La, Mill Hill, N.W.7. Electrical consultants, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Matthew Gibb and Miss C. R. Moore.

Rivala Ltd., 13 Well Court, Bow La, E.C.4. Electrical and general engineers, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: L. R. Battell and W. J. Wildman.

Stonehouse Engineering and Export Co. Ltd. To carry on business of electrical engineers, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Dorothy M. Graeme and P. G. Graeme, 61 Fairview Ave, Gillingham.

Upfold Electrical Ltd., 6a Windsor St, Chertsey, Surrey. To carry on business of electrical engineers, etc. Nom cap.: £100. Dirs.: William G. Upfold and Richard S. Boater.

Vane Electrical Instruments Ltd., 164-74 Corporation St, Birmingham 4. Nom. cap.: £1,000. Dirs.: Joseph E. T. Weaver and Geo. W. Sample.

Stanley R. Woollett Ltd., 56 Duckworth La, Bradford 9. Electricians, etc. Nom. cap.: £10,000. Dirs.: Stanley R. Woollett and Barbara Cullingford.

Calcutta Electric Supply Corporation Limited

THE Sixty-fourth Annual General Meeting of The Calcutta Electric Supply Corporation Limited was held on 9 November in London, Sir Harry Burn, K.B.E., F.C.A., the chairman, presiding.

The following is an extract from his circulated statement:—

There were increased sales to all classes of consumers during the year ended 31 March, 1961. The total energy sold of 1,955 million units shows an increase of 138 million units over the previous year. Sales of energy have increased each year for the last fourteen years and over that period sales have increased more than three-fold, thus reflecting the ever-increasing need of electrical energy, particularly for industrial purposes. Our forecasts show that this expansion will continue.

Industrial demand accounts for 90% of the energy sold for Power Purposes. The balance is divided equally between sales to Public Waterworks and for Domestic Power, the latter being used principally for air-conditioning and refrigeration.

Demand for low tension industrial power expanded further with sales increasing by 9 million units to 123 million units; the number of consumers rose by over 1,200 to more than 16,700. Consumption by Public Waterworks increased to the extent of 4% and was solely due to larger demands from the Calcutta Corporation. Sales of Domestic Power again showed a substantial rise mostly due to the growing popularity of small air-conditioning units suitable for residences and small offices.

Sales of energy for lights and fans increased by 16½ million units to 259 million units.

Public Lighting sales have increased by approximately one million units in each of the last two years. Expansion of electric street lighting by the Calcutta Corporation has not been as extensive as hitherto.

The Calcutta Tramways Co. Ltd. is the sole consumer for traction purposes. Improvements in their operating conditions is reflected in the increase in consumption of 2½ million units.

Bulk Supplies are given to some nine distributing undertakings, seven of which are owned by the State Electricity Board and the remaining two by the Riverside (Bhatpara) Electricity Supply Co. Ltd. and the Chandernnagore Electric Supply Co. Ltd.

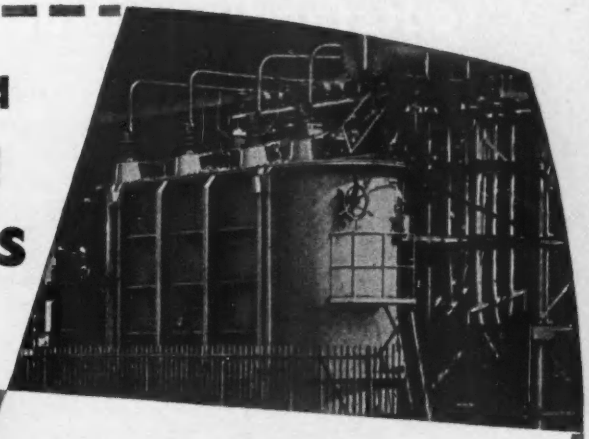
Sales under Special Contracts increased by nearly 8 million units to more than 100 million units. The bulk of those sales, and of the increase in consumption, were at our special tariff to owners of large office and residential buildings, public institutions, cinemas and hotels.

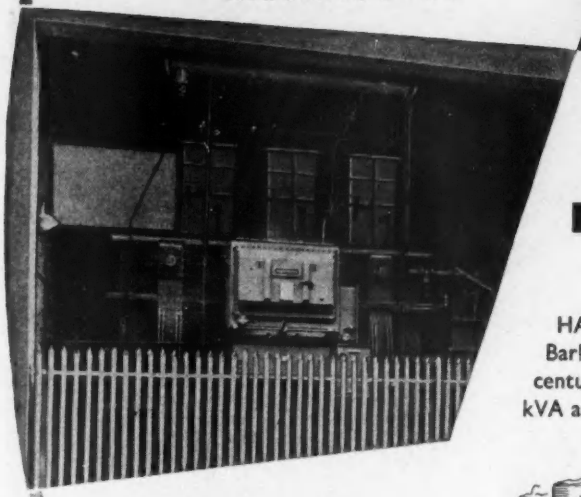
Sales of energy for the current year continue to improve. The Revenue Account shows that the revenue from the sale of current rose by nearly £1 million to £9,800,000. The Gross Revenue exceeded for the first time £10 million.

The Board propose a final dividend of 4% (actual) for the year.

The report was adopted.

over A MILLION kVA of HACKBRIDGE TRANSFORMERS installed at

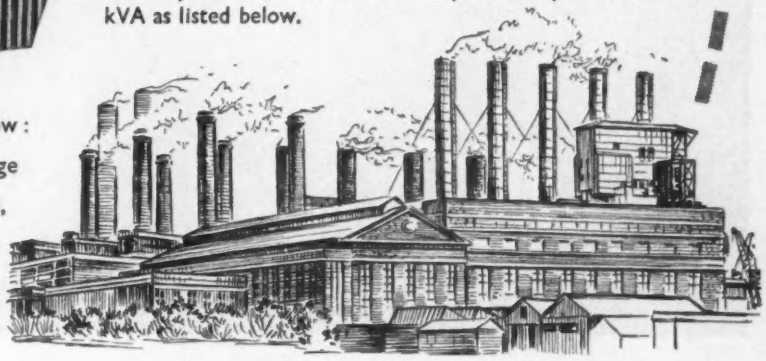




BARKING POWER STATION LONDON

HACKBRIDGE TRANSFORMERS have been installed at Barking Power Station over a period of a quarter of a century and include units in capacities up to 93,750 kVA as listed below.

The installations illustrated show: above, one of the four Hackbridge 93,750 kVA transformers, and, below, one of the three 88,750 kVA Units at Barking Power Station, London.



Four 93,750 kVA	Two 12,500 kVA	Four 600 kVA
Three 50,000 kVA	Two 10,000 kVA	Four 900 kVA
Three 88,750 kVA	Five 7,500 kVA	Four 250 kVA
Four 30,000 kVA	Four 4,500 kVA	Four 150 kVA

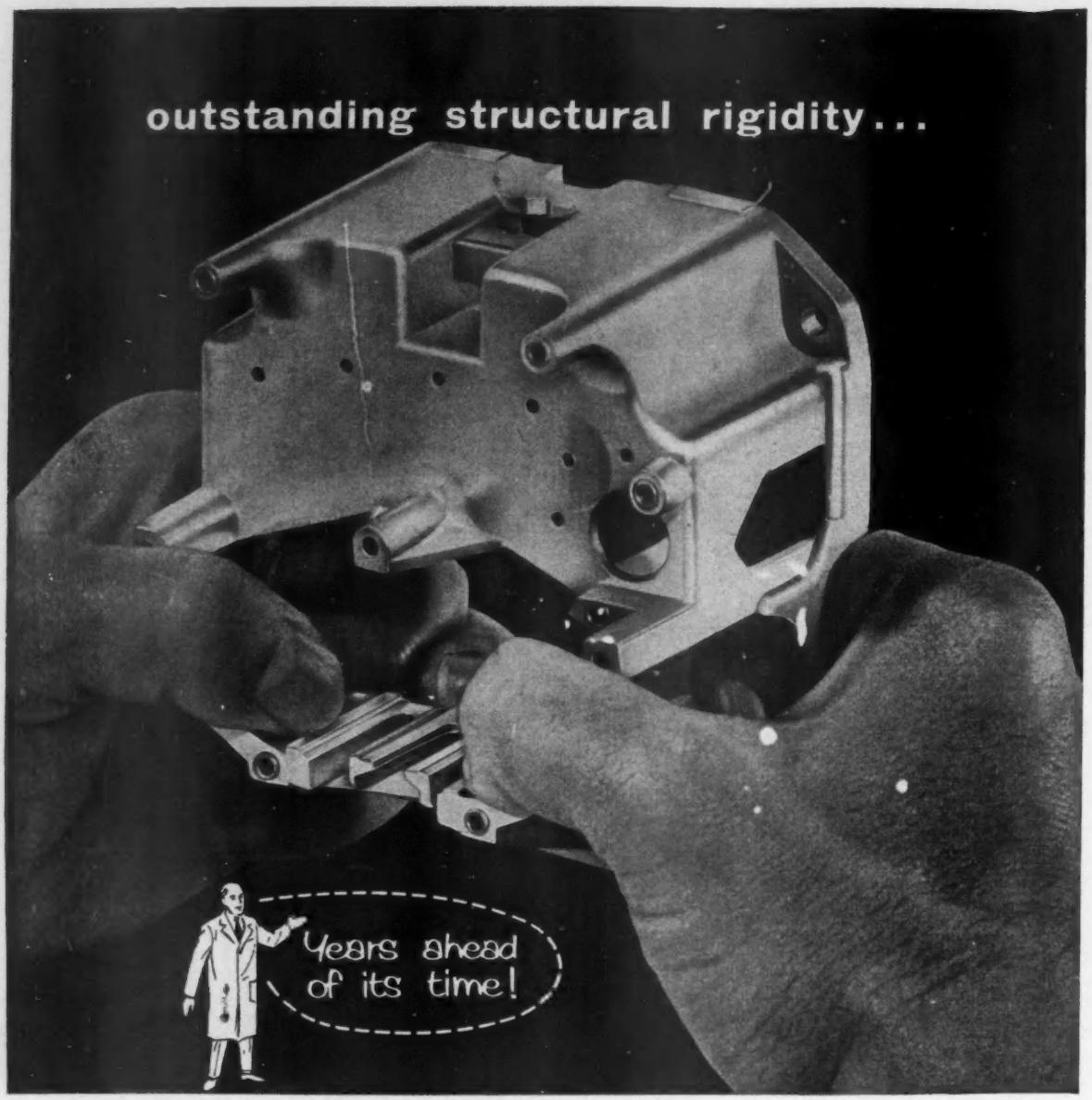
Also other miscellaneous units totalling 4,000 kVA

T20

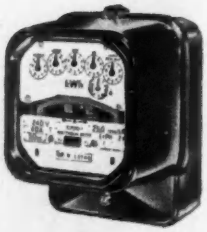
HACKBRIDGE AND HEWITTIC ELECTRIC COMPANY LTD

HERSHAM · WALTON-ON-THAMES · SURREY

Telephone: Walton-on-Thames 28833 (8 lines) Telegrams & Cables: "Electric" Walton-on-Thames



Consider this grid casting... The SANGAMO Watthour Meter embodies the very finest in materials and design. The grid casting is an outstandingly fine example of modern production technique. Made from an aluminium silicon alloy of absolute stability, it is a one-piece pressure die-casting on which no subsequent machining operations are performed. No maintenance of any sort is required. By utilising the most advanced quantity production methods in the world's most modern meter factory, it has been possible to incorporate better materials, better workmanship and better design features with the utmost economy. Thus the benefits of increased demand are passed on to the user.



SANGAMO WESTON

sangamo

MODEL S200-7 SINGLE PHASE WATTHOUR METER

SANGAMO WESTON LTD., ENFIELD, MIDDX., ENGLAND · Tel: Enfield 3434 (6 lines) & 1242 (6 lines) · Grams: Sanwest Enfield SW/77

CLASSIFIED ADVERTISEMENTS

PUBLIC NOTICES

SYMPOSIUM ON HOSPITAL LIGHTING

A ONE-DAY Symposium on Hospital Lighting is being held in University College, Gower St, on 5 Jan., 1962, under the sponsorship of the Ministry of Health and the D.S.I.R. Building Research Station. The Symposium is designed for architects and engineers, both from Regional Hospital Boards and in private practice, and others particularly concerned with problems of hospital lighting. Papers will be given on the principles of hospital lighting, light sources and engineering, architectural and medical requirements. These will be followed by a discussion. The conference will be introduced by Professor Richard Llewelyn Davies and the principal speakers will be Mr J. Constable, Dr B. H. Crawford, Mr J. Green, Dr S. T. Henderson, Dr R. G. Hopkinson, Mr J. Musgrove, Mr D. J. Petty and Dr Wellwood Ferguson. The cost of the course, including coffee, lunch and tea will be one guinea. The numbers attending the course are limited and applications, together with the price of the tickets, should be made as soon as possible to Miss J. M. Beauchamp, Ministry of Health, Savile Row, W.1. Cheques and postal orders should be made payable to the Ministry of Health and crossed "Bank of England A/c H.M. Paymaster General." (C 536)

TENDERS INVITED

THE URBAN DISTRICT COUNCIL OF HOYLAKE

TENDERS are invited for the supply of 1,700 electric time switches with solar dials for street lighting purposes.

Form of Tender, General Conditions and Specifications may be obtained on application to the Engineer and Surveyor, 8 Riversdale Rd, West Kirby, Wirral, Ches.

Tenders to be delivered to the undersigned to arrive not later than first post on Wednesday, 6 Dec., 1961.

The Council does not bind itself to accept the lowest or any tender.

FRANK BARNES,
Clerk of the Council.

Town Hall,
Hoylake.
7 Nov. 1961. (C 542)

APPOINTMENTS VACANT

MIDDLESEX COUNTY COUNCIL

County Architect's Dept.

ELECTRICAL ENGINEERING ASSISTANT

REQUIRED, APT II (£815/£960 plus London Weighting up to £40. Established. Prescribed conditions. Should have practical experience of installation work in buildings or knowledge of electrical contractor's office procedure to assist in preparation of drawings and specifications covering wiring of buildings. Application forms (s.a.e.) from County Architect, 1 Queen Anne's Gate Bldgs, Dartmouth St, S.W.1, returnable by 27 Nov. (Quote H.829/ET.) (C 546)

KENYA

Ministry of Works

ELECTRICAL ENGINEERS

QUALIFICATIONS: Candidates aged 26-45 years must be A.M.I.E.E. or Grad. I.E.E. with administrative ability, and should have knowledge of thermal and hydraulic prime movers, instruments and testing and workshop practice including factory regulations. Experience is required in either (a) the design of the electrical content of schools, hospitals, airfields, etc.; or (b) in the work and legislation controlling distribution and supply of electricity in a public electricity supply undertaking.

Duties: Officer will be employed initially in the sphere of his principal experience, but will be expected to work in other spheres mentioned after appropriate guidance.

Terms: On contract for two tours of 24 months in the first instance.

Total Emoluments (Salary plus gratuity): In scale £1,582/£3,060 p.a.

Free passages. Generous leave. Free medical attention. Education allowances up to £200 per child.

Apply Director of Recruitment, Department of Technical Co-operation, Carlton Hse Terr, London S.W.1, quoting BCD 112/7/027/D10, giving full name, age and brief details of qualifications and experience. (C 534)

BOROUGH OF WILLESDEN

APPLICATIONS are invited for suitably qualified and experienced persons for the following appointment:

SENIOR ELECTRICAL ENGINEER

SCALE B (£1,505/£1,670 p.a.)

Candidates should have experience in the design of electrical installation in multi-storey blocks of flats and public buildings.

The Council are prepared to make a mortgage advance for house purchase and a contribution up to £25 towards the cost of removal expenses.

Full details and form of application may be obtained from Borough Engineer, Town Hall, Dyne Rd, Kilburn, N.W.6, and should be returned by not later than 10 a.m., on Monday, 4 Dec., 1961.

R. S. FORSTER,
Town Clerk.
(C 535)

CIVIL SERVICE COMMISSION

PATENT EXAMINERS AND PATENT OFFICERS

PENSIONABLE posts for men or women, normally under 36 on 31 Dec., 1961, for work on the examination of Patent applications. Qualifications: normally a degree, or Dip. Tech., with first or second class honour in physics, chemistry, engineering, or mathematics, or equivalent attainment, or professional qualification, e.g., A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., A.M.Inst.Chem.Eng., A.R.I.C., A.Inst.P. Inner London salary: £793/£1,719: starting salary may be above minimum. Promotion prospects. Write Civil Service Commission, 17 North Audley St, London W.1, for application form, quoting **S/128.** (C 537)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Region

North Thames Division

APPLICATIONS are invited for the following appointments at Goldington (Bedford) and Rye House (Essex) Generating Stations:

GENERAL ASSISTANT ENGINEERS

Salary: N.J.B. within the range of Scales 1-3, £625/£805 per annum plus 10% Shift Allowance when required to work on shift.

The duties of the successful applicants will include assisting in the Control Room on shift and other operation and investigation duties.

The commencing salary will depend upon qualifications and the duties and responsibilities.

Preference will be given to applicants who have had previous experience in a Generating Station and who have reached the standard of the Ordinary National Certificate in Electrical Engineering or its equivalent.

Applications, stating age, qualifications, experience and present position, should be sent to the Assistant Regional Personnel Officer, Central Electricity Generating Board, South Eastern Region, North Thames Division, West Farm Pl, Chalk La, Cockfosters, Barnet, Herts, to arrive not later than 25 Nov., 1961.

F. W. SKELCHER,
Assistant Regional Director.
(C 545)

CENTRAL ELECTRICITY GENERATING BOARD

OPERATIONAL SERVICES ENGINEER

APPLICATIONS are invited for the appointment of Operational Services Engineer in the Nuclear Operations Branch of the Operations Department at Headquarters, Friars Hse, London S.E.1.

This is a senior post and the successful candidate will be responsible for co-ordinating the operation, maintenance and staffing of the Board's nuclear power stations.

Candidates should preferably possess a university degree in engineering and be corporate members of a senior Engineering Institution. Experience in the nuclear field is desirable though not essential, but candidates must possess sound practical experience of the operation and management of power or heavy engineering plant.

Salary within the Scale £2,440/£2,655 per annum.

Applications stating age, qualifications, experience, present position and salary, to Mr H. C. Spear, Chief Personnel Officer, 24-30 Holborn, London E.C.1, by 4 Dec. QUOTE REF. ET/509. (C 555)

THE SOUTH WALES ELECTRICITY BOARD

GENERAL ASSISTANT ENGINEER

(DRAUGHTSMAN)

APPLICATIONS are invited for the position of General Assistant Engineer (Draughtsman) in the Mid-Wales and North Mon. (Brecon) District of the Monmouthshire and Mid-Wales Area.

Salary: N.J.B. Class E, Grade 10, Scale 4 (£765/£870 per annum).

Applications stating age, present position, present salary, qualifications and experience, should be addressed to W. E. Richardson, M.I.E.E., Manager, Monmouthshire and Mid-Wales Area, Llywelyn Rd, Cwmbran, Mon., to arrive not later than 2 Dec., 1961.

Please quote reference 102/61/ET, endorsing envelope "General Assistant Engineer (Draughtsman)."

Previous applicants need not re-apply as their applications will be reconsidered.

R. G. WILLIAMS,
Secretary.
(C 551)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 46s. per inch, and all other classified advertisements at 3s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

THE EAST MIDLANDS ELECTRICITY BOARD

Leicestershire and Warwickshire Sub-Area

SUB-AREA SECRETARY

Vacancy No. 124/61.

SALARY: £2,170/£2,380 per annum in accordance with Class C, Grade 5, of the National Joint Managerial and Higher Executive Grades Committee Agreement.

Applications are invited for the post of Sub-Area Secretary in the Leicestershire and Warwickshire Sub-Area, which will become vacant in Feb., 1962.

Candidates should have had a wide administrative experience in a senior appointment in the Electricity Supply Industry, and should have a professional qualification.

Applications stating age, qualifications, experience, present position and salary, should be forwarded to the Secretary, The East Midlands Electricity Board, Mapperley Hall, Lucknow Ave, Nottingham, so as to reach him not later than 2 Dec., 1961. Applications, quoting Staff Vacancy No. 124/61, should be sent in a confidential envelope endorsed "Sub-Area Secretary." (C 556)

YORKSHIRE ELECTRICITY BOARD

Head Office

DEPUTY CHIEF ENGINEER

APPLICATIONS for the position of Deputy Chief Engineer are invited from suitably qualified and experienced engineers. Corporate Membership of the Institution of Electrical Engineers is an essential qualification.

Salary: N.J.M. and H.E. Class D, Grade 9, £3,270/£3,515 per annum.

Applications, together with the names of two referees, should be sent to the Secretary, Yorkshire Electricity Board, Wetherby Rd, Scarcroft, Leeds, not later than 27 Nov., 1961.

No. 3 (Sheffield) Sub-Area

SUB-AREA COMMERCIAL OFFICER

Applications are invited for the appointment of Sub-Area Commercial Officer in the No. 3 (Sheffield) Sub-Area. Applicants should have a sound knowledge of tariffs, experience of negotiations with consumers, management of service centres and supervision of contracting work. Possession of an appropriate professional qualification is desirable.

Salary: N.J.M. and H.E. Class E, Grade 5, £2,595/£2,815 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Change Alley, Sheffield, not later than 27 Nov., 1961.

No. 7 (Grimsby) Sub-Area

SUB-AREA ENGINEER

Applications are invited from professionally qualified electrical engineers for the appointment of Sub-Area Engineer in the No. 7 (Grimsby) Sub-Area.

Salary: N.J.M. and H.E. Class B, Grade 6, £2,170/£2,380 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Rd, Grimsby, not later than 27 Nov., 1961.

No. 4 (Leeds) Sub-Area

SECOND ASSISTANT ENGINEER

(OPERATION AND MAINTENANCE)

Applicants should have had considerable experience in the operation and maintenance of substation equipment, overhead and underground distribution systems operating up to 66 kV. A sound knowledge of all relevant safety requirements and regulations is essential.

Salary: N.J.B. Class L, Grade 7 (Scale 13), £1,440/£1,610 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Elec-

continued in next column

continued from previous column

tricity Board, Bramhope, Leeds, not later than 1 Dec., 1961.

No. 1 (Bradford) Sub-Area

THIRD ASSISTANT ENGINEER

(DRAUGHTSMAN)

This vacancy is in the Construction Engineer's Section of the Sub-Area Engineer's Department, at present located at Dockfield, Shipley. The successful candidate will be required to lead the Building and Civil Section, the principal duties of which are the preparation of drawings and estimates for new building works and for alterations to existing buildings. A knowledge of tender procedure and contract supervision would be an advantage.

Salary: N.J.B. Class L, Grade 10 (Scale 10), £1,190/£1,325 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45-53 Sunbridge Rd, Bradford 1, not later than 1 Dec., 1961.

No. 5 (Wakefield) Sub-Area

BARNSLEY DISTRICT

ASSISTANT INSTALLATION ENGINEER

Applicants must have had a sound technical education and practical experience in electrical contracting work of all types. They must be capable of preparing and supervising schemes for all classes of domestic, commercial and industrial installations, including specifications, estimates and tenders. Experience in electrical appliance repairs would be considered an advantage. Applicants must have had considerable experience in the control of workmen.

Salary: N.J.B. Class J, Grade 10 (Scale 8), £1,040/£1,165 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Rd, Wakefield, not later than 1 Dec., 1961. (C 561)

THE NORTH WESTERN ELECTRICITY BOARD

SECOND ASSISTANT DISTRICT ENGINEER

NORTH-WEST DISTRICT, ECCLES

THE duties will include the supervision of the erection and maintenance of substation switchgear, laying and jointing of cables, and switching operations on the H.V. and L.V. systems within the District as required. Applicants should have had a wide general experience on the distribution side of electricity supply, and be prepared to undertake standby duties. Corporate Membership of the Institution of Electrical Engineers will be an advantage.

Salary Scale: £1,190/£1,325 p.a., Grade H.7, N.J.B. Conditions.

Applications on forms to be obtained from the Manager (Staff Vacancy), No. 1 Sub-Area, The North Western Electricity Board, Town Hall, Manchester 2, P.O. Box 493, and returned to him by 27 Nov., 1961.

SECOND ASSISTANT ENGINEER

(CONSTRUCTION)

SUB-AREA ENGINEERING DEPARTMENT

KENDAL

Applicants should be experienced in the construction of H.V. and E.H.V. overhead lines on wood poles and steel towers and in the laying of 11 kV and 33 kV underground cables. Experience in the preparation of specifications covering the installation of overhead lines and underground cables will be an advantage. Experience also in the design and construction of 33 kV substations will be necessary.

The minimum technical qualification will be the H.N.C. in Electrical Engineering or equivalent.

Salary Scale: £1,350/£1,500 p.a., Grade K.7, N.J.B. Conditions.

Applications on forms to be obtained from the Manager, No. 6 Sub-Area, The North Western Electricity Board, Castle Green, Kendal, and returned to him by 27 Nov., 1961. (C 547)

THE EAST MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited from suitably qualified and experienced persons for the following appointments. Applicants should state age, qualifications, experience, etc., and quote the appropriate Vacancy No.

Northamptonshire Sub-Area

THIRD ASSISTANT DISTRICT COMMERCIAL ENGINEER

DAVENTRY DISTRICT, TOWCESTER

(DOUBLE-HEADED)

Vacancy No. 125/61.

Salary: N.J.B. Class E, Grades 9-10, £765/£940 per annum, depending on the experience and qualifications of the successful candidate.

The duties will include assisting in the negotiations for the supply of electricity to consumers, advice on tariffs, electrical installations and appliances, sales activities and consumer service, the control of service centres and the preparation of specifications and estimates for electrical installations and the supervision of contracting work.

The person appointed will be required to live in or near Towcester.

Applications should be forwarded to the Manager, Northamptonshire Sub-Area, 25 Bridge St, Northampton, by 1 Dec., 1961.

Mansfield and North Nottinghamshire Sub-Area

SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEER

WORKSOP DISTRICT (DOUBLE-HEADED)

Vacancy No. 126/61.

Salary: N.J.B. Class F, Grade 8, £965/£1,090 per annum. It is anticipated that the Worksop District will be reclassified to Class G from 1 April, 1962.

The duties will include assisting in the negotiations for the supply of electricity to consumers, advice on tariffs, electrical installations and appliances, sales activities and consumer service, the control of service centres, and the preparation of specifications and estimates for electrical installations and the supervision of contracting work.

Ability to drive a motor vehicle is essential, and the person appointed will be required to live in or near Worksop.

Applications should be forwarded to The Manager, Mansfield and North Nottinghamshire Sub-Area, Lime Tree Pl, Mansfield, Notts, by 1 Dec., 1961. (C 560)

SOUTH EASTERN ELECTRICITY BOARD

SENIOR SHOWROOM ASSISTANT

KINGSTON DISTRICT

SALARY: £780 x £25—£880 in accordance with N.J.C. Grade 3 plus London Weighting. Superannuable. The position calls for an enthusiastic salesman with drive and initiative for the Kingston showroom. The successful applicant may be required to work at any of the district showrooms. Applicants should have had experience in electricity showrooms and be capable of controlling staff, advising consumers on appliances and tariffs and dealing with general inquiries. Possession of E.D.A. Salesmanship Certificate an advantage.

Applications, quoting ET, on forms from District Manager, Seeboard, 22 Claremont Rd, Surbiton, Surrey, by 29 Nov., 1961.

FITTER (ELECTRICAL)

BRIGHTON AND HOVE DISTRICT

Wages: 5s 6½d for a 42-hour, five-day week under N.J.I.C. Agreement. Candidates should have served a recognised craft apprenticeship and have had experience in the erection and maintenance of high voltage and medium voltage switchgear, transformers, and associated control equipment. Contributory pension scheme optional.

Applications, quoting ET and naming two referees, to District Manager, Seeboard, Electric Hse, Castle Sq, Brighton, by 27 Nov., 1961.

GEORGE WRAY,
Secretary.
(C 559)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Project Group

SECOND AND THIRD ASSISTANT ENGINEERS (MECHANICAL)

APPLICATIONS are invited for the appointments of Second and Third Assistant Engineers (Mechanical) in the Midlands Project Group at Bournville.

Applicants should preferably be Corporate Members of the Institution of Mechanical Engineers or have qualifications admitting thereto, and should have experience in the design, manufacture, and installation of modern power station mechanical plant.

Duties will involve the preparation of specifications, examination of Tenders, and general contract development work and correspondence.

The salary will be within Grade 5, Scale 15, £1,460/£1,830 per annum for the Second Assistant Engineer, and Grade 7, Scale 13, £1,320/£1,610 per annum, for the Third Assistant Engineer.

Applications should be submitted to the Administrative Officer, Midlands Project Group, P.O. Box 314, Birmingham 30, not later than 1 Dec., 1961.

Envelopes should be marked "Confidential—Staff Vacancy No. MPG.68/61." (C 554)

SOUTH WESTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following position:

THIRD ASSISTANT DISTRICT ENGINEER (PROTECTION)

TORBAY

Salary within Class G, Grade 9, Salary Scale 7, £965/£1,090 per annum, of the N.J.B. Agreement.

Duties will include the maintenance of all protective gear in the District; the carrying out of pressure tests and fault location tests, and assistance to the Construction Engineer, when necessary, on the installation of switchgear and protective gear. The person appointed may be required to undertake standby duty.

Corporate Membership of the Institution of Electrical Engineers or technical qualifications leading thereto are desirable, together with the possession of a current driving licence.

Applications to be made on Standard Form AE6/ACT, OBTAINABLE BY POSTCARD ONLY from the District Manager, South Western Electricity Board, Electric Hse, Union St, Torquay. Closing date for receipt of completed applications is 2 Dec., 1961. (C 557)

EDA

TECHNICAL OFFICER

The British Electrical Development Association requires a Technical Officer specially expert in promoting the use of electricity for domestic purposes. Ability to write fluently and clearly is essential. Knowledge of publicity and film making very advantageous. Corporate membership of I.E.E. desirable. Salary in the region of £2,000 depending on age and qualifications. Applications, giving full particulars of education, training, qualifications, age and experience to be sent before 1 Dec., to:

Director and Secretary,
The British Electrical Development Association,
2 Savoy Hill, London W.C.2.
(C 499)

ABERDARE CABLES LIMITED

Manufacturers of Paper and Plastic Insulated Cables, require an Electrical Engineer to take control of their Development Department. This will be a senior position responsible directly to the Chief Engineer.

Applicants must possess an engineering degree, have had some cable experience and preferably some knowledge of experimental techniques. Age 28-32.

Apply by letter, in strict confidence, giving complete details of technical qualifications, experience and salary to:

The Secretary,
Aberdare Cables Ltd.,
Aberdare, Glamorgan.
(C 569)

SOUTHERN ELECTRICITY BOARD

THIRD ASSISTANT ENGINEER (MAINTENANCE AND OPERATION)

SUB-AREA Engineer's Department of No. 4 (Bournemouth) Sub-Area. Salary: N.J.B. Class M, Grade 11 (£1,190/£1,325 per annum). N.J.B. Conditions of Service.

The successful applicant will be required to assist the Senior Assistant Engineer (Technical) in his duties, including the maintenance of fault, and other statistics and records; network protective gear and switchgear problems and a variety of technical work relating to commissioning, operation and maintenance of the Board's distribution system. Applicants should have had experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems. The possession of suitable technical qualifications would be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, 1 Priory Rd, Bournemouth, Hants, and returned to him, quoting Z.1344, not later than 27 Nov., 1961.

DEMONSTRATOR

Basingstoke District of No. 3 (Portsmouth) Sub-Area. Salary: N.J.C. Grade I (£600 x £25—£700 per annum). N.J.C. Conditions of Service.

Applicants should be qualified to advise generally on the utilisation of electric domestic appliances, to give public demonstrations of apparatus and to assist in showroom duties. The possession of an E.A.W. Certificate or equivalent Domestic Science qualification would be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton La, Cosham, Portsmouth, and returned to him, quoting Z.1433, not later than 27 Nov., 1961.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. (C 558)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

No. 4 Sub-Area

APPOINTMENT OF SECRETARY

APPLICATIONS are invited for the above appointment at the headquarters of the Board's No. 4 Sub-Area at Rhostyllen, near Wrexham. The Sub-Area covers North Wales and parts of Cheshire and Shropshire. Duties will include establishments and personnel matters, the acquisition of property and wayleaves and general administration. Experience in common law claims and insurance, and a knowledge of superannuation schemes will be an advantage. Candidates should preferably possess a recognised secretarial or other suitable qualification.

The salary will be in the range of £2,380/£2,595 per annum.

Applications should be submitted to the Secretary at Board Headquarters, Love La, Liverpool 3, so as to be received not later than 8 Dec., 1961. (C 571)

CENTRAL ELECTRICITY GENERATING BOARD

South Thames Division

LITTLEBROOK POWER STATION

Vacancy No. 176a/61.

ASSISTANT ENGINEER (EFFICIENCY)

THE successful applicant will assist in the Station Efficiency Section in investigations into the thermal performance of plant. Technical qualifications to O.N.C. standard are desirable and practical experience in generating station work would be an advantage.

Salary: N.J.B. Class I., Grade 16, £815/£920 per annum including London Allowance.

Applications giving age, details of experience, qualifications, etc., should be sent to the Station Superintendent, Littlebrook Power Station, nr. Dartford, Kent, to arrive by 24 Nov. (C 550)

NORTHAMPTON COLLEGE OF ADVANCED TECHNOLOGY

Electrical Engineering Department

APPLICATIONS invited for new post of

CHIEF SENIOR LABORATORY TECHNICIAN

in the above Department. Duties involve supervision of laboratory staff, responsibility for the planned maintenance of equipment, and construction of new apparatus.

Candidates should possess a Higher National Certificate in Electrical Engineering, or equivalent, and have had appropriate industrial experience. The post is permanent and pensionable, with five weeks' annual leave.

Salary: £940 x £30—£1,060 p.a.

Applications to Head of Department, St. John St, E.C.1. (C 562)

CENTRAL ELECTRICITY GENERATING BOARD

West Midlands Division

STATION SHIFT CONTROL ENGINEER

REQUIRED at Ocker Hill Power Station, Tipton, Staffs. N.J.B. service conditions, superannuable appointment, salary within Schedule A of the Agreement, Grade G.10, £890/£1,015 per annum, plus 10% shift allowance (minimum £90).

A sound technical training and practical experience in the control of steam generating plant and main switchgear are required. Appropriate technical qualificatoins an advantage.

Apply, quoting Vacancy No. 257/61MR on Form AE6, available from the Station Superintendent, Ocker Hill Power Station, Bayley's La, Ocker Hill, Tipton, Staffs, by 27 Nov., 1961. (C 541)

CHIEF TEST AND INSPECTION ENGINEER

to be responsible for all testing and inspection of power transformers up to 5 MVA and extensive range of special equipment including transductors, welding transformers, static rectifier sets and voltage regulators. The work includes impulse and noise testing as well as experimental and development testing.

Education level up to H.N.C. is necessary with experience of transformer manufacture and testing, together with the ability to supervise and train personnel and deal with customers.

Apply, in writing, giving full details, quoting reference T1, to:

Chief Engineer,
GRESHAM TRANSFORMERS LTD.,
Twickenham Rd, Hanworth, Middlesex.
(C 539)

MINNESOTA MINING & MANUFACTURING COMPANY LTD.

require the services of a

GRADUATE PHYSICIST

OR

ELECTRICAL ENGINEER

in their Technical Service Department near Swansea, South Wales.

The work is concerned with advising customers on the use of the Company's products as supplied to the Electrical Industry, the development of new techniques and new applications and the provision of technical information to the Sales Force. A considerable amount of travelling within the U.K. will be involved.

Candidates should be between 23 and 33 years of age and possess a University Degree in Physics or Engineering. Experience in the Electrical Industry is highly desirable. Salary will be according to age, qualifications and experience.

Please send details of education and career to date to:

Personnel Officer,
Minnesota Mining & Manufacturing Company Ltd.,
Penllergaer, Gorseinon, nr. Swansea, Glam.

(C 544)

BRITISH RAILWAYS
(Western Region)

TECHNICAL ASSISTANT

GENERAL DRAWING OFFICE
SWINDON

To take charge of Section dealing with the design of industrial electrical installations, including high and medium voltage supplies, substations, electric lifts, capstans, etc. Sound technical training in both Mechanical and Electrical engineering essential.

Commencing salary £1,050 p.a., rising to £1,125 after two years.

Superannuation Scheme. Sick Pay. Travelling facilities.

Applications to:

Chief Mechanical and Electrical Engineer,
British Railways, Western Region,
Swindon, Wilts.

(C 530)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

Birmingham Area

THIRD ASSISTANT ENGINEER

(TECHNICAL AND PLANNING SECTION

AREA ENGINEER'S DEPARTMENT

HEADQUARTERS)

The successful applicant will be required to assist in the design of the H.V. and M.V. networks, analysis of loading conditions, preparation of specifications and layout of plant and equipment. Salary: £1,275/£1,410 per annum or £1,350/£1,500 per annum (N.J.B. Grade N.11 or N.10), according to qualifications and experience. Apply, by letter, within 14 days, stating age, experience, present position and salary to Emil Braathen, Manager, Midlands Electricity Board, 14 Dale End, Birmingham 4.

Central Gloucestershire Area

DEMONSTRATOR (FEMALE) (STROUD)

Applicants must have had a good education and should have a certificate of a recognised Domestic Training College and/or the E.A.W. Certificate, and have had at least two years' training and experience. Applicants must be prepared to take an active part in the sales organisation and selling experience would be an advantage. Duties include lecture demonstrations in Service Centres and on consumers' premises, and advice to consumers on the selection and use of electrical apparatus. Salary: £600/£700 per annum (N.J.C. Grade 1). Apply, by letter, within 14 days, stating age, education, qualifications, training and experience, to Mr S. Raybould, Area Manager, Midlands Electricity Board, Eastern Ave, Gloucester.

Shropshire and Herefordshire Area

ASSISTANT (PURCHASING DEPARTMENT

AREA HEADQUARTERS)

Duties include the maintenance of stores reference lists and continuous review of stores holdings. Salary: £700/£775 per annum (N.J.C. Grade 2). Apply, by letter, stating age, qualifications, experience, present position and salary, to Mr W. Winwood, Area Manager, Midlands Electricity Board, Spring Gdns, Ditherington, Shrewsbury.

F. W. CATER,
Secretary.
(C 543)

OVERHEAD TRANSMISSION LINE ENGINEERS

Large contracting organisation has vacancies for AGENTS, SUB-AGENTS and ENGINEERS on 275 kV and 132 kV Steel Tower and Wood Pole Line Contracts in Scotland. State age and give full particulars of experience to Box No. 577, Keith and Co., 11 Castle St, Edinburgh. (C 528)

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern Region

REGIONAL ELECTRICAL DEPARTMENT

FOURTH ASSISTANT ENGINEERS

(PLANNING)

APPLICATIONS are invited from suitably qualified engineers for positions as Fourth Assistant Engineers in the System Planning and Development Section of the Regional Technical Branch at Leeds. The successful candidates will be required to assist with system studies employing a.c. and d.c. calculators, and with planning extensions to the transmission system.

The salary for these appointments will be in accordance with the National Joint Board Agreement, Class K, Grade 9, 10 or 11 (£900/£1,325 per annum), according to qualifications and experience.

Forms of application may be obtained from the Regional Personnel Officer, Central Electricity Generating Board, North Eastern Region, 1 Whitehall Rd, Leeds 1, to whom they should be returned to arrive not later than 4 Dec., 1961. (C 563)

Eastern Electricity

Essex Sub-Area

SENIOR ASSISTANT

ESTATES AND WAYLEAVES SECTION

SECRETARIAL OFFICER'S DEPARTMENT

237/61R.

THE duties will include negotiations for the acquisition of substation sites up to 33 kV, obtaining wayleaves and dealing with agricultural and other damage claims for compensation.

Salary: N.J.C. Grade 4 (£934 10s/£1,060 per annum) inclusive of London Allowance.

Apply by letter, giving age, education, qualifications, experience and details of present and previous appointments, to the Secretarial Officer, Essex Sub-Area, Eastern Electricity Board, Millfield, Bentley, nr. Brentwood, Essex, by 1 Dec., 1961.

SOUTH-WEST ESSEX DISTRICT

FOURTH ASSISTANT ENGINEER

236/61R.

Applicants should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems, including substations.

Salary: N.J.B. Class K, Grade 11 (£1,090/£1,215 inclusive of London Allowance).

Apply by letter to W. T. Langfield, Manager, South-West Essex District, Eastern Electricity Board, Ashton Rd, Harold Hill, Romford, Essex, by 1 Dec., 1961. (C 552)

AUSTRAL STANDARD CABLES

requires a CHIEF ENGINEER

CHIEF ENGINEER

AUSTRALIA

£A3,500

This Company is Australia's largest telecommunication cable manufacturing company with factories in Victoria, New South Wales and New Zealand.

The Chief Engineer will be based in Melbourne and be directly responsible to the general manager for all technical aspects of the company's business. There are excellent prospects for further promotion.

Candidates aged 35-45 must be graduates in electrical engineering and have at least five years' experience in the communications cable industry.

Salary will be not less than £A3,500 with generous pension arrangements. Passages will be paid and assistance given with housing.

Applications in confidence should be addressed to MPD at the associate company (Standard Telephones and Cables Limited, Connaught House, 63 Aldwych, London W.C.2). Quote Ref. ET/25. (C 549)

J. & P.

MANAGER OF SWITCHGEAR DEPARTMENT

Johnson & Phillips Ltd. invite applications for the position of Manager of their Switchgear Department. The man appointed will be responsible to the Board for the whole of the Company's switchgear activities including the development, production, commercial and administrative aspects. These activities include the control of the technical policy of the Company's overseas factories in South Africa, Australia, India and Pakistan. The Company's main switchgear factory is situated at New Cross, London. The vacancy arises from the sudden decease of Mr. P. T. Davies, B.Sc., A.M.I.E.E.

Applications giving full details of qualifications, age and experience should be addressed to the

Director and General Manager,
Johnson & Phillips Ltd., Charlton, S.E.7

(C 553)

RTB

RICHARD THOMAS & BALDWINS LIMITED

SPENCER WORKS

Applications are invited for the following vacancies in the

ELECTRICAL ENGINEERING DEPARTMENT

of the integrated iron and steel plant now under construction at Llanwern, near Newport, Mon.

SHIFT CONTROL ENGINEERS

The successful candidates will be required to man a distribution control centre handling voltages up to 275 kV and the Works' own generating plant. This is highly responsible work; previous experience is essential, and applicants must have a knowledge of modern switchgear and protective systems. They should also have served a recognised apprenticeship.

Age range: 22-50.

Please quote Ref. No. 202/5A in your original letter of application.

SENIOR TECHNICIANS, OPERATION

Applicants should have operating experience with high-voltage switchgear, transformers, and rectifiers on a large distribution system, and should be familiar with "permit to work" procedure.

Successful candidates will be required to work shifts, and will assist the Shift Control Engineer in maintaining supplies throughout the plant. This will include carrying out switching operations and assisting with fault-finding on equipment at voltages up to 33 kV.

Age range: 25-45.

SENIOR TECHNICIAN, PROTECTION

Applicants should have experience in commissioning, testing, and maintaining protective gear for alternators, transformers, rectifiers, and other high-voltage equipment.

Age range: 25-45.

All the above are staff positions, and candidates should possess a Higher National Certificate in electrical engineering. The work offers exceptional opportunities for those who are interested in the latest techniques of control engineering as applied to heavy industry.

Please quote Ref. No. 202/7A in your original letter of application for Senior Technicians, Operation, and Senior Technicians, Protection.

Application forms, which should be returned by 24th November, may be obtained from:

The Manager, Staff & Labour Relations Department,
RICHARD THOMAS & BALDWINS LIMITED
Spencer Works, Llanwern, Nr. Newport, Mon.

(C 527)

CROMPTON PARKINSON
(CHELMSFORD) LIMITED

require a

SENIOR TEST ENGINEER

An experienced man, conversant with the testing of medium sizes a.c. and d.c. machines is required in our rotating machine test section. Applications should be sent in confidence to:

Personnel Officer,
Crompton Parkinson (Chelmsford) Ltd.,
Writtle Rd,
Chelmsford, Essex.

(C 566)

DRAUGHTSMEN

required in long established and progressive company. Permanent and progressive position offered to men holding O.N.C. or equivalent who are used to producing a high standard of work and with experience in design layout and detailing in either of the following fields:

A.C. and D.C. electrical machines
Motor control gear and panels.

Details of qualifications and experience should be sent to the

General Manager,
Newton Brothers (Derby) Ltd.,
Alfreton Rd, Derby.

(C 449)

CORPORATION OF LONDON
City Surveyor's Department

Applications are invited for appointment as:

ELECTRICAL ENGINEERING ASSISTANT

Salary up to £1,310. The post is permanent and superannuable and subject to medical examination.

Candidates should be Graduate Members, Institution of Electrical Engineers, and have had experience in preparation of schemes for electrical lighting, heating and power installations in public buildings, electric lifts and small ventilating schemes and the maintenance of existing services.

Applications, stating age, previous appointments and experience, with names and addresses of two referees, to:

The City Surveyor,
Guildhall, London E.C.2,

within 14 days.

(C 570)

BRITISH ENGINE BOILER AND ELECTRICAL INSURANCE CO. LTD., Longridge Hse, Manchester 4. ELECTRICAL SURVEYORS required in England and Scotland. Permanent positions carrying progressive salary scale £825/£1,225 with non-contributory pension. Candidates aged 26 to 32, with H.N.C. in Electrical Engineering or Grad. I.E.E. and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply, stating age, qualifications and experience. (C 529)

CONSULTING ENGINEERS require SENIOR ELECTRICAL DESIGNER (Building Services) capable of planning and designing services, all types buildings, including boiler houses, etc., with minimum supervision. Junior also required. Send details: Hoare, Lea and Ptnrs., Building 332 (South Side), R.A.F., Northolt, Ruislip, Middx. (C 504)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

ELECTRICAL DRAUGHTSMAN, age 25-45, wanted for development work associated with electrical power cables and accessories. H.N.C. (Elect.) preferred, but not essential if applicant has some electrical drawing office experience. Write, stating full particulars, salary required, etc., to:
Engineering Manager, Power Cables Dept., Associated Electrical Industries Ltd., Caole Division, Gravesend, Kent. (C 568)

ELECTRICIAN with overseas experience, preferably oil-field, required immediately by drilling contractors for maintenance of diesel alternators in Nigeria. Two years' single status contract. Please write, giving full details of experience, age, etc., to Box No. 8477, Electrical Times. (C 572)

ELECTRICAL INSTALLATIONS DRAUGHTSMAN required by leading company of London engineers. Preference given to applicants with experience on power and lighting distribution. Progressive appointment in congenial surroundings for man with initiative and drive. Salary subject to negotiation, but probably between £105/£125 per month. Applications to Box 8473, Electrical Times, please, giving details of appointments held, etc. (C 538)

MAJOR PETROLEUM DISTRIBUTION COMPANY require for their London Office a fully experienced ELECTRICAL ENGINEER for development of new projects and the maintenance of existing electrical installations. Applicants preferably should have experience in flame-proof construction, be familiar with codes of practice relative thereto and be well versed in the technical supervision of contracted work.
Progressive salary, permanent career, first-class pension scheme covering widows and dependent children. Legal fees and removal expenses involved in house transfer paid for married men.
Please reply by brief letter, giving details of age, education, qualifications and previous experience to Box XA122, c/o Mathers and Streets, 110 Old Broad St, E.C.2, quoting Reference No. D/293. Replies can only be sent to those selected for interview. (C 533)

REQUIRED by old-established firm of electrical engineers and contractors, a CONTRACTS ENGINEER for permanent overseas position. Able to take charge of office at manager level. Must have experience of estimating, contract management, administration of U.K. and local labour. Applicants must produce evidence of their experience. Applicants should state completely their experience, salary expected and at least three references. Application should be marked Private and Confidential, reference C.E.—Box No. 8471, Electrical Times. (C 524)

REPRESENTATIVE, preferably with connection in Electricity Boards and some knowledge of distribution, required for Southern England, South Wales and Midlands. Good prospects for keen, energetic man. Apply: Ref. IHL, Bowthorpe Electric Co. Ltd., Crawley, Sussex. Tel.: Crawley 28888. (C 532)

SALES LIGHTING ENGINEER required London area. Contributory Pension Scheme, car provided. Apply F. W. Thorpe Ltd., Welby Rd, Hall Green, Birmingham. (C 531)

TECHNICAL ASSISTANTS, age 25-35, with special ability in mathematics, required to deal with design problems in the development, use and application of electric power cables, excluding pressure types, and associated technical correspondence. Also inquiries, chiefly impregnated paper and plastics. Minimum qualification: H.N.C. (Elect.), but degree in Electrical Engineering preferred. Membership of I.E.E. an advantage. Write, stating qualifications, salary required, etc., to:
Engineering Manager, Power Cables Dept., Associated Electrical Industries Ltd., Cable Division, Gravesend, Kent. (C 567)

AGENCIES

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PRL, Pantin, Paris.
(C 488)

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HOUSE-SERVICE METERS, A.C. or D.C., quarterly or prepayment. — Universal Electrical, 221 City Rd, London E.C.1. (C 3)

PURLEY CHOKES AND BALLASTS. Our 80 W tapped h.p.f. ballast with starter switchgear-holder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s 6d each subject. —F. W. Blanshard Ltd. (Dept. E.T.), Purley, Surrey. Uplands 4818/9. (C 4)

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INFRA RED WORKS, HIGH ROAD, N.11.
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OUTPUT: GREATER THAN 1,000 kW.
200 VOLTS OR ABOVE
Rewinding Considered.
Reply in first instance to:
Box No. 8469, Electrical Times.
(C 506)

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ALTERNATORS and Lighting Sets, 3 kW to 75 kVA, a.c. or d.c., for hire. Welding Sets, 3/400 A.—Reeds Cranes and Plant Hire Ltd., Newcastle upon Tyne. Tel.: 33311. (C 486)

PATENTS

THE proprietor of British Patent No. 753151, entitled "Electrical Terminal Clip," offers same for licence or otherwise to ensure practical working in Great Britain. Inquiries to Singer, Stern and Carlberg, 140 So. Dearborn St, Chicago 3, Illinois, U.S.A. (C 564)

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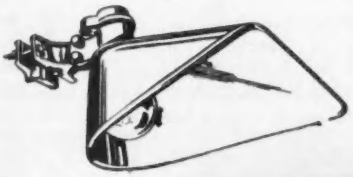
List No. 890
'Reslux' Overhead Mounting model, for G.L.S. or M.A./V. lamps.



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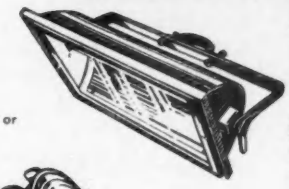

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Downward lighting Sodium Lantern for wall or pole mounting.

List No. 775
'Festival' Lanterns for G.L.S. lamps from 100 watt to 1000 watt size.

List No. 920
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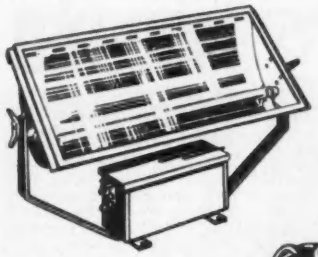
Our Illuminating Engineering Department is at your service for the preparation of floodlighting schemes.



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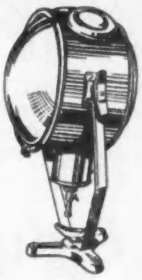

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List No 556
Narrow beam Projectors for 500 watt to 1,500 watt G.L.S. lamps.

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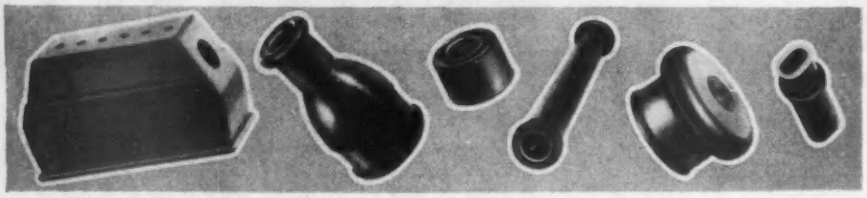

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CENTRAL ELECTRICITY GENERATING BOARD
(YORKSHIRE DIVISION)

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Two 20 MW sets

The first eight boilers of the first Ferrybridge station — Ferrybridge A — built in 1927 by the Yorkshire Electric Power Co., were 57,000 lb./hr. units steaming two *20MW* turbines and were supplied by The Stirling Boiler Company Limited, a member of the BABCOCK organization.

FERRYBRIDGE B
THREE BOILERS 1957-59
Three 100 MW sets

So also were the three 760,000 lb./hr. boilers of Ferrybridge B, commissioned in 1957-59 — the first of the Central Electricity Generating Board's modern reheat units — to steam three *100MW* generators; with steam conditions of 1600 lb./sq. in. s.o.p. and 985°/955°F.

now... FERRYBRIDGE C

Four 500MW
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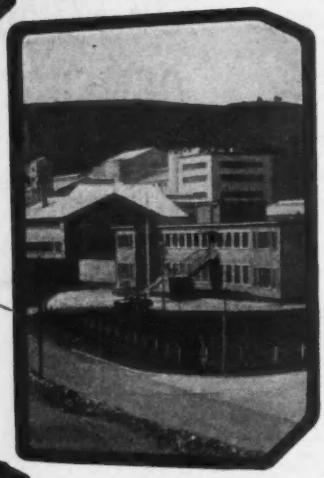

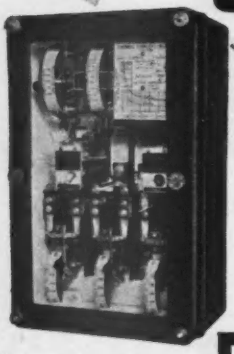

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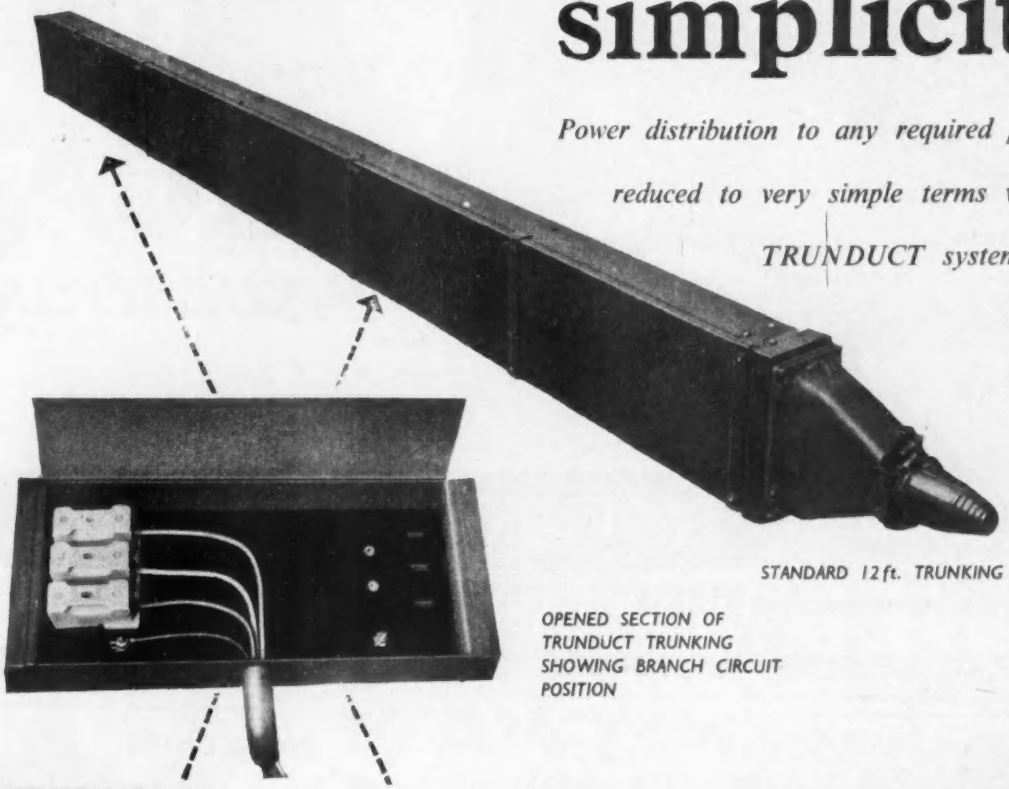

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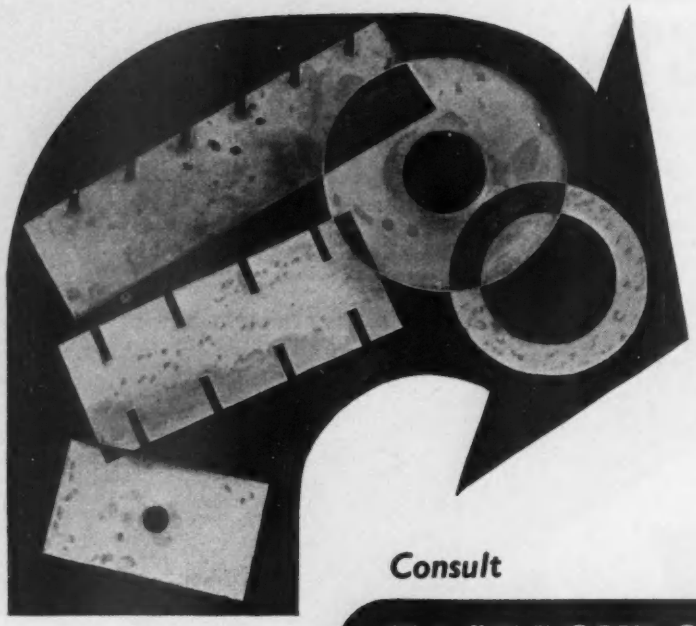

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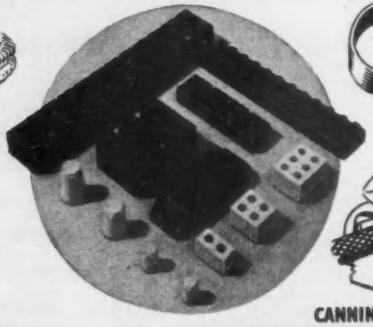

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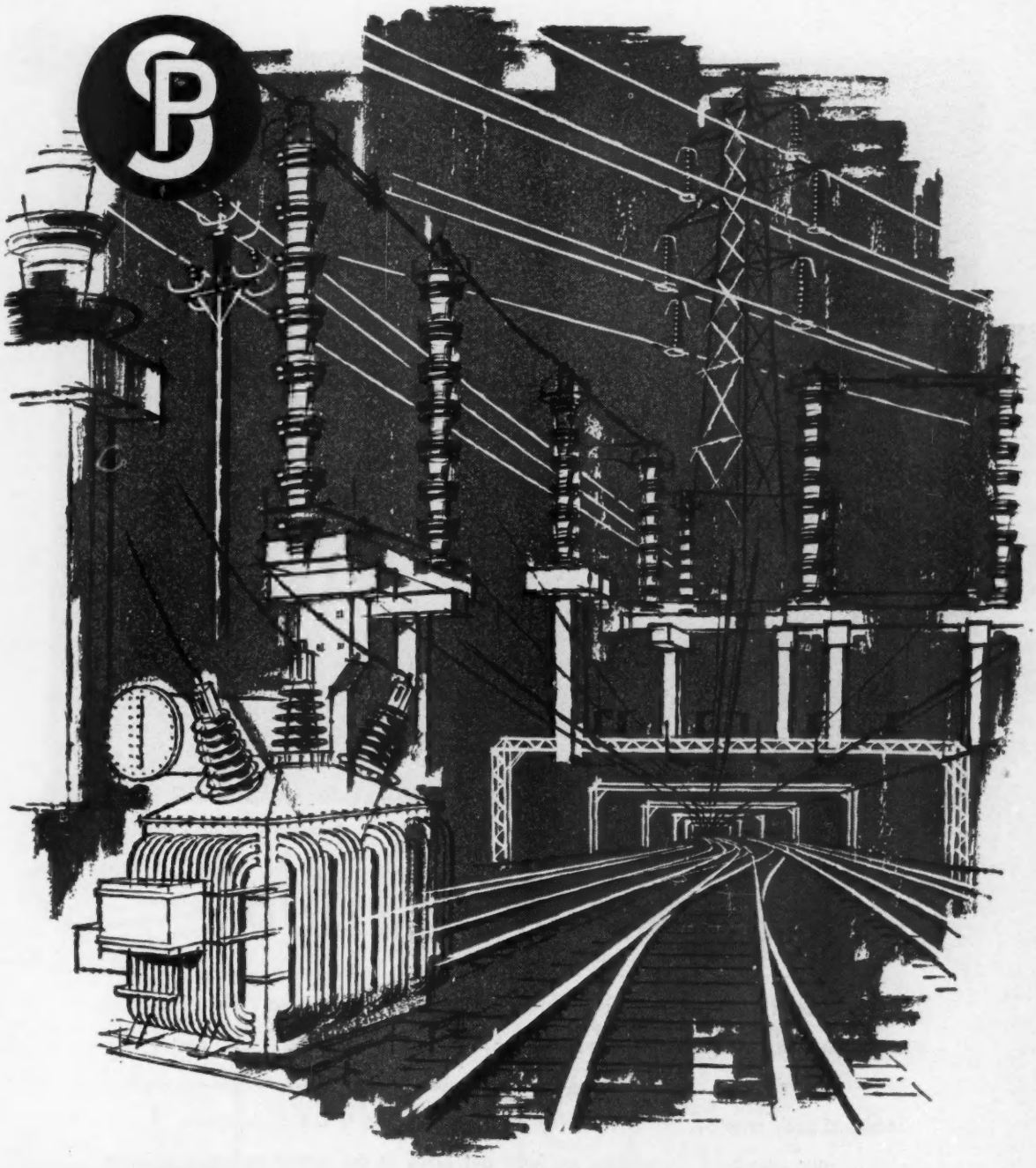

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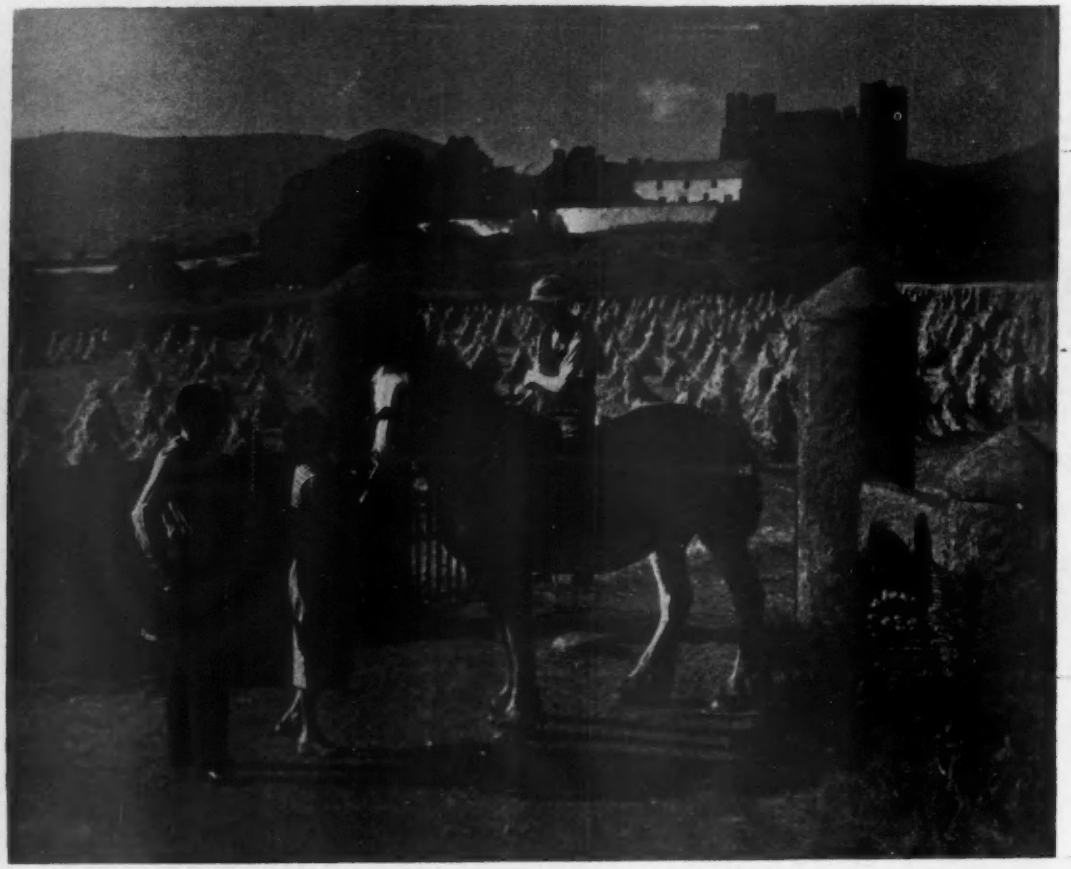

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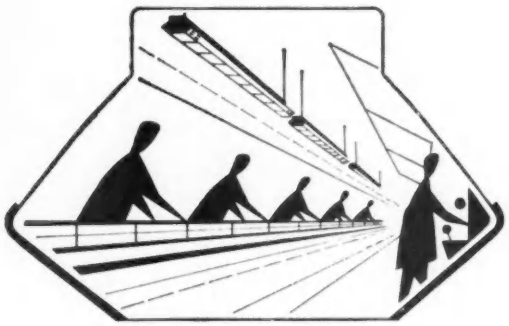

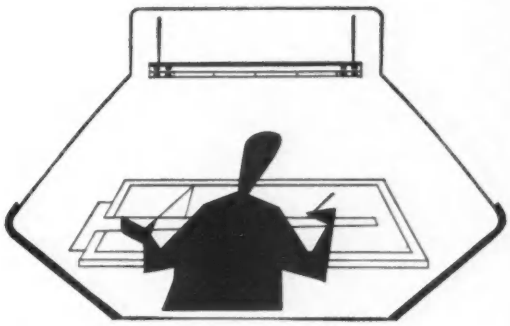

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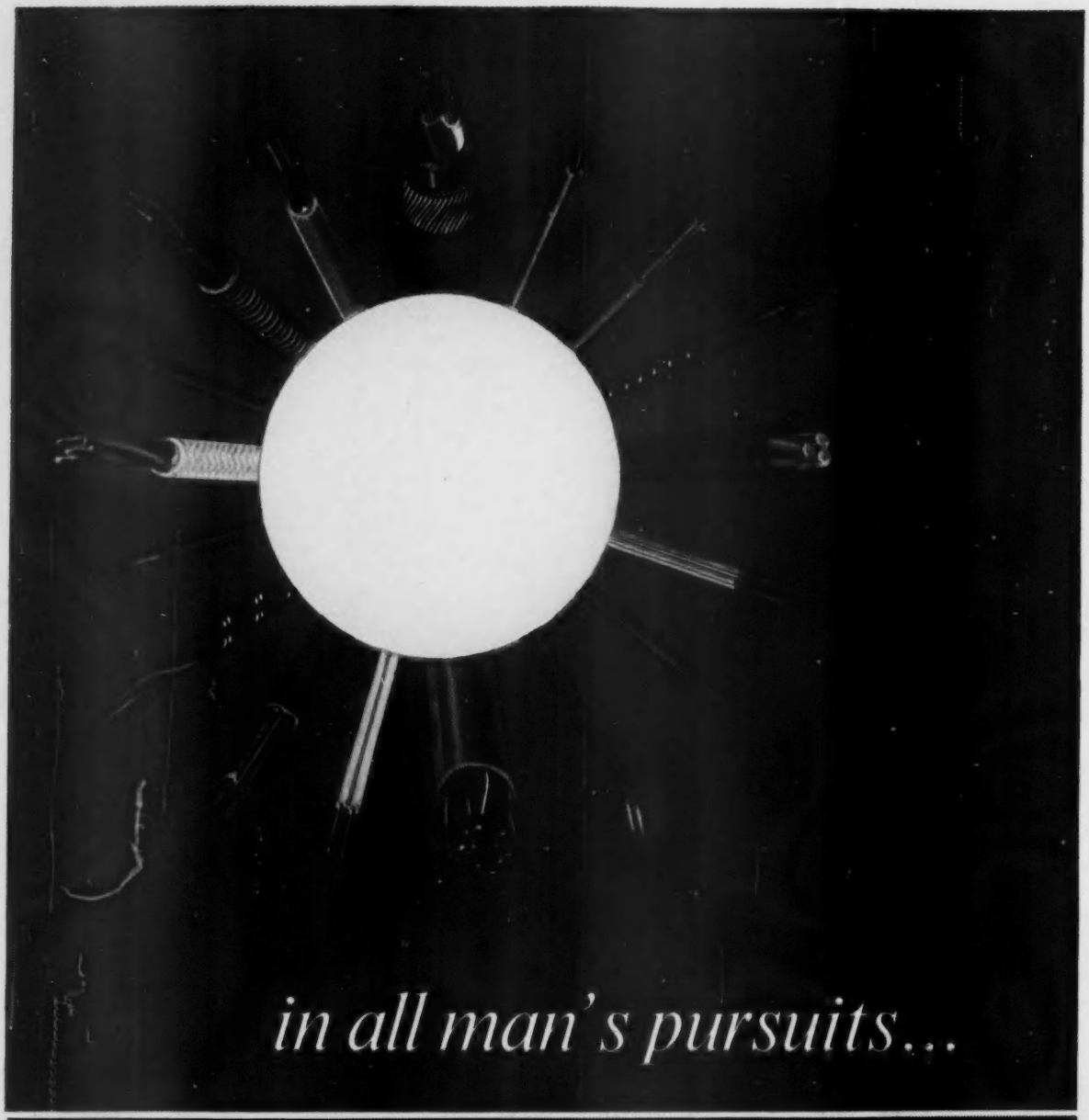

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